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THESIS

**DEVELOPMENT AND IMPLEMENTATION OF AN
INTERACTIVE UNIFORM REGULATIONS MANUAL FOR
THE UNITED STATES MARINE CORPS**

by

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September 2006

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**DEVELOPMENT AND IMPLEMENTATION OF AN INTERACTIVE UNIFORM
REGULATIONS MANUAL FOR THE UNITED STATES MARINE CORPS**

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Submitted in partial fulfillment of the
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MASTER OF SCIENCE IN COMPUTER SCIENCE

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ABSTRACT

There are two main purposes to this thesis study. First, we will deploy the principles of software development that we have learned at NPS and test its validity through the development of a real world system. This system will be a completely self sustaining prototype of a web-based interactive military uniform regulation manual. Second, we will conduct a study of Human Computer Interaction (HCI) through the design and usability testing of the new interactive uniform regulations manual. All military services currently possess their own individual uniform regulations specific to each service. This system, although specifically designed for the United States Marine Corps, can be used as a model for any other service as well as any international military desiring a similar solution to the inherent problems associated with current manuals. The new system will address all aspects currently outlined in the regulations. This regulation will be used by all US civilians and military service members to whom the current manual is now relevant. Although we fully intend to deliver a finished product to the Marine Corps for their official use, the true value to us as students is in the process of developing and testing this new system. The knowledge learned here will benefit us in any future system design or development projects.

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LCDR Carsten Krause

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I. INTRODUCTION

The two main purposes of this thesis study are to deploy the principles of software development that we have learned at NPS and test their validity through the development of a real world system. This system we developed is a completely self sustaining prototype of a web-based interactive military uniform regulation manual. Second, we conducted a study of Human Computer Interaction (HCI) through the design and usability testing of the new interactive uniform regulations manual. All military services currently possess their own individual uniform regulations specific to each service. This system, although specifically developed for the United States Marine Corps, can be used as a model for any other service as well as any international military desiring a similar solution to the inherent problems associated with current manuals. The new system addresses all aspects currently outlined in the regulations. This regulation can be used by all US civilians and military service members to whom the current manual is now relevant. Although the finished product is ready for official use by the Marine Corps, the true value to us as students was in the process of developing and testing this new system. The knowledge learned here will benefit us in any future system design or development projects.

The benefits of studying the iterative process of software development are invaluable to any Computer Scientist. In our capacity as military officers, whether in the US Military or the German Armed Forces, we will be involved in the development of new military software systems. Whether it is as procurement officers, advisors, or full project managers, we will need to possess the skills inherent to software development. Regardless of the role, the experience necessary to handle the intricacies required in software development is difficult to acquire. We will be confronted with situations that require close interaction with civilian contractors who already have years of experience in this field. We will need to have a skill set to assess the functionality of proposed systems and intelligently challenge the contractors. This thesis will allow us the best opportunity to develop these skills in the most expeditious manner.

The scope of this thesis was to create an easy to use web-based graphical user interface (GUI) based uniform regulation guide along with the design and creation of a server required to house such a web site. The guide was implemented using primarily visual aides and follows the practices of good Macro/Micro Human Computer Interaction (HCI) Design. The aim was to provide the needed information to the user in an intuitive GUI interface that requires minimal “mouse clicks” to retrieve the desired information and we feel that we have satisfied that requirement. The guide also provides the user with alternative text from the current regulations manual dealing with the specific uniform in question. The end result is an easy to use research tool that may be utilized by any Marine to ensure that their uniform is within regulations. Our anticipated server requirements were to develop a system that was self contained and independent of existing hardware/software requirements of the proposed client group. For that purpose, we specifically used the open source software Apache HTTP Web servers, PHP (> version 4), and MySQL. Our design allows the client side to use any available web browser.

The documentation provided here details our research and progress for this project. In Chapter II we provide background information of the current problems with the existing Marine Corps uniform regulations manual. We detail how we intend to meet the needs of the intended users of this new system. We also provide some general background information regarding the Unified Process for software development that we followed throughout development of this application. We chose to follow the Unified Process mainly because it is the state-of-practice in today’s software industry, which was taught to us here at NPS, and it is the process that we felt most comfortable with. In this chapter, we outline the Unified Process with particular emphasis on the importance of use cases. We end the chapter with a close look at HCI and the concerns associated with good web design from an aesthetic point of view.

Chapter III is where we provide a detailed account of our journey through this entire process. We breakdown the Inception Phase, the Elaboration Phase, the Construction Phase, and the Transition Phase and discuss how we approached each phase within the framework of the Unified Process. Here you will find how we created our use cases and how we fully developed our requirements for this site. Our complete

Requirements Document can be found in Appendix I but we summarize it in Chapter III. We also outline our design strategy which puts us into the Elaboration Phase. During this phase we mapped out our ideas for a design that will meet the specific requirements of the Inception Phase. We again summarize our System Design Specification which can be found in Appendix II. In Chapter III we also discuss our security measures, evolution, risk analysis, and our approach to the HCI issues outlined in Chapter II.

In Chapter IV we detail the testing phases of the prototype. We conducted three formal rounds of testing with three different populations. Our testing audience grew with each round as well as the functionality of the application during the tests. Chapter V concludes our work with a look at future work still left to be done in this area.

It is important to keep in mind that although we were able to create a valuable product that serves a needed purpose for the Marine Corps, it is the process and not the product that is the focus of this thesis. There are countless books and web sites available to offer guidance on practices for good web site development. In our research, we discovered that the majority of these references only cover the aesthetics of web design and deal primarily with efficient layouts of web pages. The focus is on the product and neglects to give solid details of the process required for effective web design. In today's enormous e-commerce market, web sites that are being built are extremely complicated and intricate and rival the complexities of a large software development project. We can find several types of software development processes, one of which is the Unified Process followed here, that are currently being used to help software developers navigate through developing software systems. The software engineering discipline is focused on improving the software development process to allow for on-time and on-budget software but there lacks the same guidance for the web site development process. This lack of regulation is puzzling since, after all, web sites are software and, with the growing functionality found in today's web sites, suffer the same shortfalls of software such as budget and schedule.

We have attempted to prove our point that since web sites behave exactly like software, they should be able to be developed with the same process. We attempted to use the well known Unified Process for complex software system development and

develop a complex web site with it. Our approach was to follow the Unified Process learned here at the Naval Postgraduate School as closely as possible and use it in developing a web based uniform regulations manual for the United States Marine Corps. We took a rather large liberty in that our team played both the role as developer and customer. We did not officially involve the United States Marine Corps in developing this site since, again, it was the process that was our main interest. Since one of our thesis members is a US Marine, we felt that we could adequately play both roles and still accomplish our goal of this thesis. We thoroughly tested the web site on active duty Marines, as described in Chapter IV of this document, so we feel confident that we accurately represented the intended users of this site. This document states our results.

II. BACKGROUND

A. INTRODUCTION

The current official Marine Corps Uniform Regulations Manual is available in hardcopy or PDF only. There are some web based manuals that can be found on the internet but none of them are designated as an “official” source for information by Headquarters Marine Corps. There is not a Graphical User Interface system currently in existence for this information, and in its current form, the manual is not well written in an easy to use manner.

Major issues/concerns with the existing manual:

- Different services have different manuals; there is no “single-instance” access available covering all services.
- Manuals may require multiple pages to be repeatedly referenced before being fully understood.
- Verbiage can be distracting and cause regulations to be misunderstood.
- It does not provide a “quick reference” for user convenience.
- Changes to regulations require entire manuals to be generated and replaced, leading to older versions with outdated materials still in circulation.
- Not written to be “user intuitive”.
- Even experienced users can have problems quickly accessing the information they require.
- The following is a list of items that must be supported in order for our system to properly meet the needs of current users:
- Reference uniform components and items for the prescribed uniform of the day (e.g. what comprises Service Dress Bravo?)
- Reference allowed locations to wear a particular uniform (e.g. Cammies not allowed off base for Marines)
- Identification of medals and ribbons
- Reference order of precedence for medals and ribbons
- Identification of all uniform insignia
- Identify correct location for all uniform insignia as well as for medals and ribbons

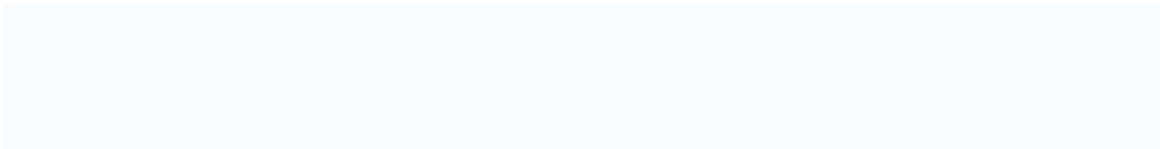
- Identify correct location for uniform components (e.g. proper wearing of cover, proper length of tie or pant leg)
- Reference any accessories allowed and their proper wear or usage (e.g. purse or umbrella)
- Reference proper grooming standards
- Miscellaneous uniform issues

B. UNIFIED PROCESS

The Unified Process is a popular iterative and incremental software development process. It should be viewed more as a framework which can be customized for specific software development projects. According to (Brugge and Dutoit, 2003)

The unified process distinguishes important time ranges called “cycles” in the lifetime of a software system. Note that these are different from the cycles in the spiral model: they can be thought of as characterizing the stage of maturity of the software system during its lifetime...A cycle generally ends with a release of the system as a product to the customer. Each cycle can be in one of four states called phases: Inception, Elaboration, Construction, and Transition.

All four phases are divided into a series of time driven iterations that can be revisited after the process has started. Each iteration results in an increment, which is a release of the system that contains added or improved functionality compared with the previous release. Figure 1 shows how the relative emphasis of different disciplines changes over the course of a project. Although most iterations will include work in most of the process disciplines (e.g. Requirements, Design, Implementation, Testing) the relative effort and emphasis will change over the course of the project.



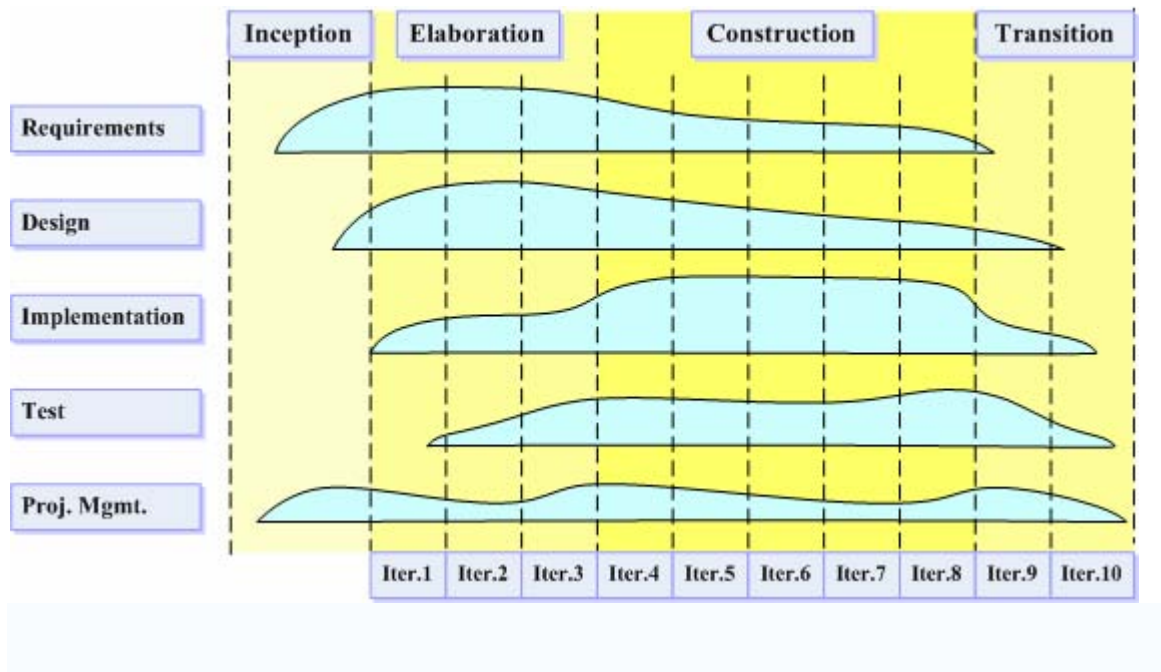


Figure 1. Unified Process

The following is a brief synopsis of each phase based on The Unified Process explained by (Scott, 2001):

Inception Phase:

Inception is the smallest phase in the project, and ideally it should be quite short. If the Inception Phase is long then it is usually an indication of excessive up-front specification, which is contrary to the spirit of the Unified Process.

The following are typical goals for the Inception phase.

- Establish a justification or business case for the project
- Establish the project scope and boundary conditions
- Outline the Use Cases and key requirements that will drive the design tradeoffs
- Outline one or more candidate architectures
- Identify risks
- Prepare a preliminary project schedule and cost estimate

The Lifecycle Objective Milestone marks the end of the Inception phase.

Elaboration Phase:

During the Elaboration phase the project team is expected to capture a healthy majority of the system requirements. However, the primary goals of Elaboration are to address known risk factors and to establish and validate the system architecture.

The architecture is validated primarily through the implementation of an Executable Architecture Baseline. This is a partial implementation of the system which includes the core, most architecturally significant, components. It is built in a series of small, timeboxed iterations. By the end of the Elaboration phase the system architecture must have stabilized and the executable architecture baseline must demonstrate that the architecture will support the key system functionality and exhibit the right behavior in terms of performance, scalability and cost.

The final Elaboration phase deliverable is a plan (including cost and schedule estimates) for the Construction phase. At this point the plan should be accurate and credible since it should be based on the Elaboration phase experience and since significant risk factors should have been addressed during the Elaboration phase.

The Lifecycle Architecture Milestone marks the end of the Elaboration phase.

Construction Phase:

Construction is the largest phase in the project. In this phase the remainder of the system is built on the foundation laid in Elaboration. System features are implemented in a series of short, timeboxed iterations. Each iteration results in an executable release of the software.

The Initial Operational Capability Milestone marks the end of the Construction phase.

Transition Phase:

The final project phase is Transition. In this phase the system is deployed to the target users. Feedback received from an initial release (or initial releases) may result in further refinements to be incorporated over the course of several Transition phase iterations. The Transition phase also includes system conversions and user training.

The Product Release Milestone marks the end of the Transition phase.

It is important to remember that the Unified Process described above is designed to be tailored to the needs of the project. It is only a framework that provides loose guidance for developing a software system but is structured enough to clearly define each phase and desired goals of each.

C. CURRENT PROBLEMS WITH WEB DESIGN

One of the biggest problems with any software development is clearly stating and understanding the user's needs. There are several factors that lead to problems with clearly defining system requirements, which have been the subject of much research, but we are going to focus on the disconnect between client and designer in the requirements stage. Web design suffers from this problem in that projects are delayed due to a lack of understanding during the requirements stage and our research here attempts to explore a possible solution.

Poor understanding of target user needs or a client's vision, ineffective use of limited resources, misguided emphasis on the wrong design priorities, over-emphasis on technologies all will contribute to a failed, late, inappropriate or too-expensive website. Experience can teach us how to avoid pitfalls, but the greatest lesson can be learned by the least experienced: the earlier that purpose and goals are clearly defined and recorded, the more easily problems are identified and solved, the easier it is to stay focused, and the better the result is for everyone.

Somewhat surprisingly, web developers seem reluctant to adopt methods and approaches from other disciplines that could reduce their problems. Particularly during the crucial initial phase of projects, web design can benefit from emulating certain software engineering practices, including the Unified Process. (Cockburn, 2001)

D. INTRODUCING USE CASES

Use cases provide a simple, fast means to decide and describe the purpose of a project. They are successfully employed by many software engineers as a way to capture the high-level objectives of an application during the initial phase of development. There is no reason that web site developers should not also benefit from a use-case driven approach. Even a project that initially seems straightforward can balloon into an

unmanageable behemoth if the purpose is not always at the forefront of development. To define a project's use cases, we need to consider two concepts, and how they relate:

- the actors
- the goals

Actors are everyone and everything that will use, or be used, by the system. It should be noted here that “system” is being used to describe the generic idea of use cases but in the context of our thesis, “system” and “web site” are interchangeable. Goals are what one, some, or all of the actors want to achieve. To be complete, every use case must describe a specific goal and the actors that will perform tasks to achieve that goal. (Larman, 2004)

The actors are external to our system so we cannot control their behavior or inputs but we can make certain assumptions about what is expected from an actor to achieve a goal. The most obvious actor in the case of any website is a visitor to the site which in our case, our expected users are U. S. Marines. We assume that the actors are visiting our site to attain information about some part of their uniform but in general, users visit sites for several reasons, depending on the purpose of the web site. Actors are not necessarily human, as seen in our Requirements Document found in Appendix I, we have included the database as an “actor”. Whatever our vision, use cases will describe the goals achieved by actors who perform tasks.

1. An Example of Use Cases

A weblog enables its owners to communicate thoughts about a topic and others to read them and perhaps respond. The obvious weblog actors are the authors and the visitors to the web log. The author plays the role of generating the content and the visitor plays the role of reading the content and responding. The goals are to inform and to be informed.

After a little brainstorming, we could decide that some of these actors' tasks should include reading an item, creating, editing, and deleting blog content, commenting, syndicating, and some administrative tasks, such as controlling access, permissions, and accounts. Some of these tasks are common to all actors and some may be exclusive to a single actor. All of them can be encapsulated in a use case that describes our initial idea: “Publish Weblog”.

This use-case diagram illustrates the relationship between actors and goals:



Figure 2. Use case Diagram

Use-case diagrams make it easier to think about the relationships or dependencies between use cases and actors. Perhaps visitors and authors would like to be able to search for particular content already published in the weblog:



Figure 3. Use case Diagram

Both visitors and authors want to be able to search. Furthermore, it is not possible to search for content that has not yet been published. The “Search Content” use case is therefore dependant upon “Publish Weblog”.

Suppose we decided to employ Google for our searching function. Google becomes an actor and the “Search Content” use case is dependent upon Google. Google’s task as an actor is to deliver search results.

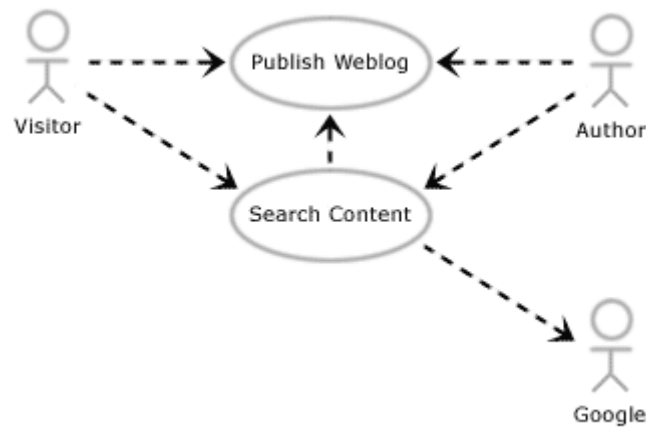


Figure 4. Use case Diagram

By now we have already identified some of the actors involved with our weblog, the goals they are trying to achieve and some dependencies between them. We can consider this a high-level conceptual architecture of our site, which will be useful when making design decisions later. (Cockburn 2001)

2. The Main Benefit of Use Cases

The crucial benefit of use cases is the way they encourage a directed method of considering project requirements. From the very beginning, we are designing a product by concentrating upon the needs and wants of those who will use it.

As with any foundation, the better our understanding of the use cases, the easier, more focused, and more appropriate will be the work that follows. Use cases are the context that allows us to easily picture where, within a project's life, a particular element will fit, thus promoting clearer decision-making throughout design and development. The purpose of describing use cases is emphatically not to fully specify the exact nature of what a new site will contain and how it is to be built. Instead, use cases define goals and purpose: the problems we are trying to solve. Establishing these goals lays the foundation for the scope that will follow. Additionally:

- If we simply consider the roles played by the actors and their goals, the use-case model can very rapidly emerge.

- Use-case diagrams can distill a complex project into a more easily comprehensible picture.
- A well-constructed use-case model can be understood by all the stakeholders in a project: developers, managers and clients. It is a powerful aid to collaborative development.
- Use cases ensure that scope is under control from the outset. The identification of use cases and their dependencies makes it easy to distinguish between core goals that must be satisfied and subsidiary enhancements that may be postponed. Scoping in this manner allows for better planning and prioritization.
- There is no consideration toward implementation so use cases can be explored without restriction. No assumptions about tools and technologies are made, nor should they be.

Use-case driven development is a mindset, as much as it is a technique. By emphasizing the actors and what they wish to achieve, project teams can advance with greater confidence and clarity. A solid early foundation of understanding amongst all concerned allows more rapid decision-making later on, and encourages a continual focus on the project's true purpose. This is not to say that use cases were the only tools we used to create our site. We used several other tools that are described below but it is the use case that is the foundation of the requirements portion of the Inception Phase. From a complete list of use cases we were able to clearly visualize the requirements and functionality of this web site. The use cases proved to be our most valuable tool in development due in large part to the unrestricted nature of creating a use case. Our use cases became a "wish list" and we later tailored the use cases as we explored capabilities within the design stage.

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III. SYSTEM DEVELOPMENT

A. OUR APPROACH

For this project, our team followed the guidelines of the Unified Process but we also tailored the process of development as we found appropriate. We were able to complete the Inception Phase, the Elaboration Phase, and the Construction Phase. The Transition Phase is still ongoing.

1. Inception Phase

We documented our work in the Inception Phase with a complete Requirements Document which is found in Appendix I. In developing our Requirements Document, we initially focused our efforts on developing use cases as described above. The Requirements Document includes a flow chart of information paths, use case diagrams, use cases, system sequence diagrams, a list of the required options for the home page along with a detailed diagram of each selection, and a decision tree to visually display the options necessary to choose a uniform display. We were initially uninhibited in our initial use case declarations but we later reviewed our use cases and tailored our list based on feasibility and time constraints of this project. We then quickly developed the boundary use cases and the use case diagrams that are simply a sketch of the actors involved in each use case.

For each use case, we developed a sequence diagram, which is another tool associated with the Unified Process. Sequence diagrams “represent the objects participating in the interaction horizontally and time vertically.” (Brugge and Dutoit, 2003) We used the sequence diagrams to detail the viability of our use cases and determine whether a system could actually support the functionality described in the use case.

We also relied heavily on flow charts in the Inception Phase. These flow charts allowed us to clearly visualize and plan for the various options that would be found in this site. This tool proved to be invaluable to us since these charts lead us directly into the Elaboration Phase. We were able to map out the log in procedures and, more

importantly, we mapped out the home page selections. It is these selections that drove the entire design process since this functionality was vitally important to the site and was the reason behind the entire concept.

Throughout the Inception Phase, we found it valuable to constantly remind ourselves of the intended audience of this system. This system will be relied on by Marines world wide as an accurate source of standards that ensure their compliance with the Marine Corps Order. The new system needs to address all aspects currently outlined in the regulations, such as proper wearing of the uniform, grooming standards, ribbon and medal precedence, civilian attire, PT gear, and optional items for male and female officers and enlisted U. S. Marines. This system could also be used by all US civilians and military service members to whom the current manual is now relevant. Keeping the audience at the forefront through the Inception Phase is vital to scoping the size and functionality of the system being developed.

As stated earlier, our team assumed the role of the client during this project. One of our team members is a U. S. Marine so we had an intended user working on the development of this system. We still felt it necessary to conduct a user analysis in order to attempt to capture the characteristics of our users and to help us narrow the necessary functionality. We concluded that the user population would be widely varied in education (civilian and professional), computer savvy, age, and cultural background. Interaction with the GUI interface to the system needs to be intuitive for the user with a high school background and minimal computer skills while simultaneously not alienating the more educated user population. Additionally, implementing multimedia suitable and appealing for both the young and older users proved arduous. Finally, in order to avoid confusion, we needed to be vigilant in our usage of terminology (especially acronyms) that is only prevalent in certain cultures.

The expected users of this system include all members of the U.S. Marine Corps as well as any other military members desiring information regarding Marine Corps uniforms. Users may also include civilians requiring the same information. The expected users will range from Marines with very little military experience to career Marines whom have dedicated a lifetime to the Marine Corps and are well versed in the

current uniform regulations as well as past versions of the manual. This system must satisfy the needs of a Marine who is new to the Marine Corps as well as the veteran. It is vital that the information provided be accurate and correct in order to prevent the user from wearing a uniform or uniform item against current policy.

This system needs to incorporate simplicity within its design. The initial design will be under the assumption that the user has basic computer operating skills and web browsing capabilities. Where applicable, the system should hide system complexity from the novice while simultaneously appealing to the expert user. No additional skill sets were assessed as being required for successful operation of the system. The majority of interaction the user will have with the system will involve “point and click” functionality.

The following are major system operations derived from the use cases found in Appendix I.

- Prospective user should be able to create a user name and password to access the site and set account information.
- Prospective user should be able to log-in to the system with a user name and password or enter the system as a guest.
- Prospective user should be able to update account information that is currently stored in the data base.
- User should be able to search for a uniform authorized for own rank.
- User should be able to gather information and photos on uniform regulations for ranks or genders other than his own.
- User should be able to access grooming standards for a male or female.
- User should be able to see awards displayed in order of precedence for their own awards or entered awards.
- User should be able to view regulations for civilian clothes.
- User should be able to view regulations for Physical Training (PT) gear.
- User should be able to view regulations for organizational clothing.

The boundary use cases found in Appendix I identify the necessary set up required for initial system functionality. The boundary use cases can be summarized as follows:

- The system must allow an administrator to put a new file into the system.
- The system must allow an administrator to edit user accounts stored in the database.

- The system must allow an administrator to add or remove an award from the database.

This system functions as a web server capable of displaying interactive pages to a user with containing text as well as images. The web server needs to interact and exchange information with a database which holds user account information as well as images to be used and displayed by the server at the request of the user. Appendix I shows high level sequence diagrams that illustrate the interaction between the user, the system and the database for the use cases given.

2. Elaboration Phase

The main documentation that captures our work during the Elaboration Phase is the Software Design Specification found in Appendix II. The purpose of the Software Design Specification is to describe the functionality of the Web Based Uniform Manual. This document describes the subsystems and modules that form the Graphical User Interface, Web Server, and Database. The Software Design Specification provides highly detailed technical data, system information, and other relevant information on the Web Based Uniform Manual. This document includes an architecture diagram, a design class diagram, interaction diagrams, state diagrams, and a glossary.

Of course the goal of any system design is to satisfy the requirements given by a client but more than that is to provide a system that will be easily used by the intended audience. What good is a system that meets all of the functional requirements if it is too difficult for anyone to use? Our goal for this project was no different. The guide will be implemented using primarily visual aides and follow the practices of good Macro/Micro HCI Design. The aim was to provide the needed information to the user in an easy to use GUI interface that requires minimal “mouse clicks” to retrieve the desired information. The guide will also provide the user with alternative text from the Marine Corps Order P1020.34G dealing with the specific uniform in question. The end result is an easy to use research tool that may be utilized by members of the United States Marine Corps to ensure that their uniform is within regulations.

Our Web Based Uniform Regulations Manual is organized into a three-tier closed architecture composed of a presentation layer, application logic layer (domain), and storage/network layer (services). The purpose of this organization is to promote reuse,

support distributed processing, and allow parallel team development. Also, by building each layer only in terms of each immediate lower layer, this design will reduce dependencies between each layer enabling the system to be combined with other hardware/software platforms with minimal rewriting of single layers.

The System Architecture decomposes the Web Based Uniform Regulations Manual system into subsystems by vertical layers and horizontal partitions. The presentation, domain, and service top layers are represented by the common graphical user interface, CTF Infrastructure, and Computer Website services subsystems respectively. Figure 5 illustrates the organization of subsystem layers and partitions within the Web Based Uniform Regulations Manual System Architecture.

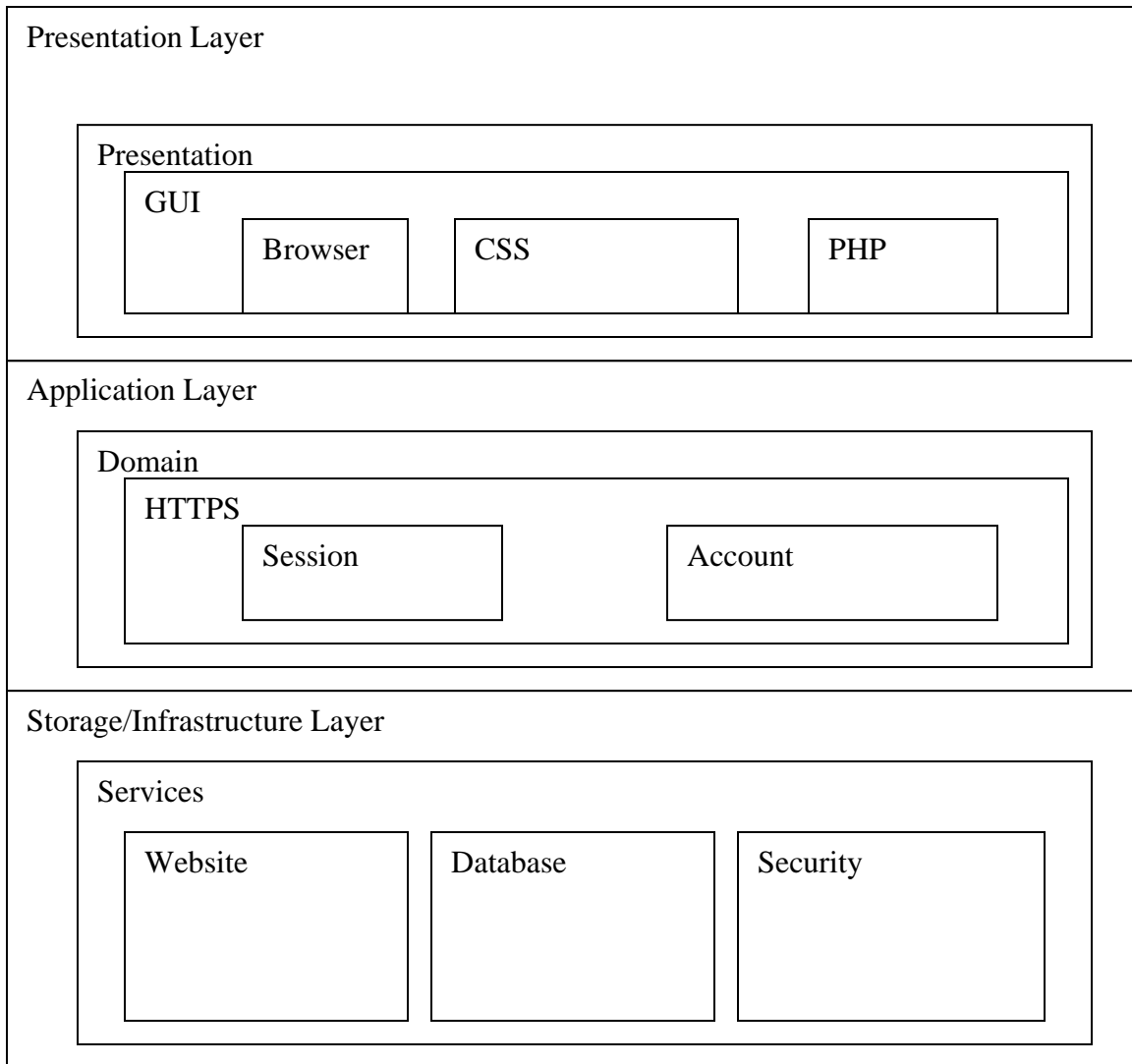


Figure 5. System Architecture

A web browser will function as the client interface. Its sole purpose is the display of the Web server generated HTML pages. To create a platform independent experience the page layout will be controlled by Cascading Style Sheets. These style sheets, once cached by the browser, will also account for faster webpage loading. All content creation will be done by server side PHP scripting, again contributing to a browser independent display without the need for client side browser plug-ins (like Java script), thus speeding up the page load time and avoiding safety critical scripting on the client computer. This will also allow handheld devices, which are not always equipped with scripting capable browser, to load and display the interface pages.

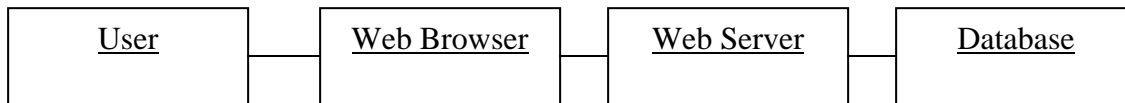


Figure 6. System Context Diagram

The middle tier is divided in two units with different functions, an intermediate layer (web server) implemented in a scripting language (PHP). This layer receives requests from the Internet clients and generates html using the services provided by the storage/Infrastructure layer. This additional layer provides isolation between the application layout and the application logic.

This system is designed to reside on an Apache Web Server. The Apache Web Server has several advantages; it is extremely powerful, modular, flexible, highly configurable, and extensible. It is freely available through open source which means that its source code is examined constantly by numerous users. This constant examination by outsiders makes it substantially more reliable than any commercial software product that can only rely on the scrutiny of a closed list of employees. Apache currently runs on approx. 68-70% of all web servers worldwide making it the #1 choice of web servers since 1996 (Appu, 2002). This makes it the most secure web server worldwide. The information on this site needs to be in complete compliance with Marine Corps Order P1020.34G. Any deviations from this standard render this site useless. The threat of hackers is always present when dealing with the web based systems. If any user can break through and change any of the information on our website, it will sacrifice the integrity of the information posted. Once the information is found to be inaccurate, it will render our system unreliable and discourage its use. Apache provides security-related configuration directives enabling administrators to tighten the security (Appu, 2002):

- User / Group: Defines user/group Apache should run as
- LimitRequestBody: Restrict total size of HTTP request body sent from a client
- LimitRequestFields: Limit number of HTTP request header fields that will be accepted from the client

- LimitRequestFieldSize: Limit size of the HTTP request header allowed from the client
- LimitRequestLine: Limits overall size of the HTTP request line that will be accepted
- Listen: Defines the IP addresses and ports the server listens on
- ServerTokens: Server HTTP response header
- ServerSignature: Content of footer available on server-generated documents
- SSLEngine: Toggle usage of SSL/TLS protocol engine
- UserDir: Indicates the location of user-specific directories

The basic design philosophy that we followed was to create four complete and separate sites that can actually completely stand alone and have a common link from the login page as shown in Figure 7.

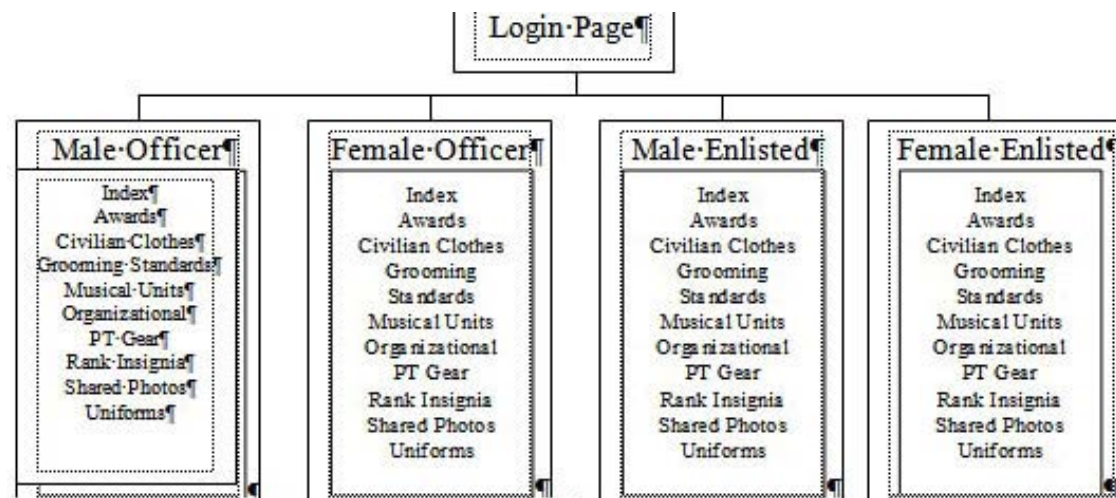


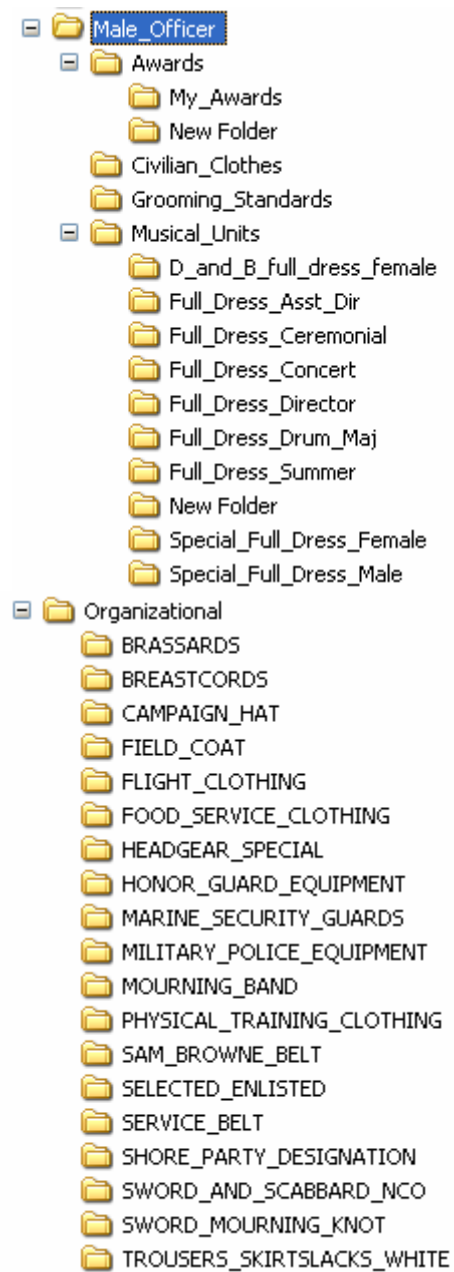
Figure 7. Overarching Design

This type of architecture allowed us to extensively test while developing the site. We first created the Male Officer “site” in its entirety and tested this module. Then we created the login page and developed its functionality. Once the login page was linked to the Male Officer “site”, we exhaustively tested this smaller system and developed it completely, as described in Chapter 5 of this document. Then it was a simple duplication of the Male Officer “site” in order to create the Female Officer “site”, the Male Enlisted “site”, and the Female Enlisted “site” (allowing for the subtle nuances of each subcategory). The final step in architecture design was to link all four subcategories to

each index page. For example, if a user is currently in the Male Officer “site” and he desires to look at female enlisted uniforms, he can quickly access the index page of the Female Enlisted “site” and navigate through that “site”.

All four subcategories share the same file names as shown in Figure 7. This allows for the quick creation of the remaining subcategories after the first one was created. This type of file naming pattern is attainable since all ranks and genders within the USMC must follow the same manual. Also all ranks and genders within the USMC have the same uniform names but the style of the uniform varies between ranks and gender. A clear and concise file structure is imperative for construction of this site and to ensure maintainability. All files needed to be arranged in a manner that was easy to follow and was unambiguous since this system will not be maintained by the original design team.

All files are placed in one of four substructures that are referenced from a main index page. As mentioned above, the files are broken up into four main categories; male officer, male enlisted, female officer, female enlisted. Figure 8 shows the file structure for male officers. This structure is simply repeated for all other categories.



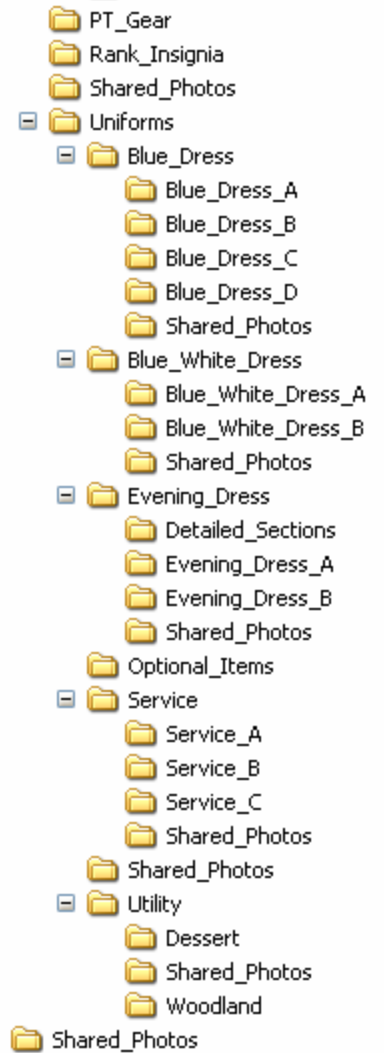


Figure 8. File Structure

3. Construction Phase

The construction phase is where we actually created the code and built the site. Part of the code is provided in Appendix V. The whole site is coded in XHTML 1.0 Transitional, CSS 2.1 and PHP 5. The combination of XHTML, CSS and PHP was chosen by us to allow for an easy maintenance of the website and represents the present time open source standard for websites that include server side scripting.

A main CSS style sheet controls the complete layout of every page. So global changes to adapt the layout to varying requirements are simple and only call for a change

in one place, the main CSS style sheet. To allow style and layout changes to single pages, each page has been given its own style sheet as well.

PHP was used mainly to assemble each page by using include statements combined with validation code. The content of each page is separated in multiple files that contain the textual information, the navigation bars and buttons and the images used on that page. This design was chosen to allow a simple implementation of changes in the original uniform manual in the corresponding web page. If for example a text of a page is changed the manager of the site only needs to open the corresponding file containing the text to be changed. By structuring the pages of the online manual this way the possibility of unintentional changes to the website are minimized. Although the text documents are HTML pages, they contain only the most necessary markup for structuring the text. This could have been done in a plain text file. The simple HTML markup however allows for color coded syntax highlighting in almost every text editor and so increases the readability of the text. The basic structure of the HTML document like head or body tags is provided and needed only in the main file that contains the include statements.

In the case that a text containing document or an image is removed from the file structure the validation code co-located with the include statements in the PHP part of the page will ensure that the page is still displayed without any problems or errors. This allows the site manager to remove unwanted or outdated contents without changes in the code of the main page. The generic naming of the files also allows for an easy replacement of pages, documents or pictures.

The top and left navigation bars are global and exist only in one place for each of the four main structures. This again allows for simple global changes should additional links be required or target URL's change.

Although research into client side scripting technologies like Ajax (McLaughlin, 2006) were done, server side scripting was chosen to allow even the weakest or highly restricted client hardware access to the site. Restrictions like low computing power or disabling of JavaScript for security reasons have no effect. The only thing the client hardware needs to provide is some kind of web browser that is capable of displaying XHTML files. The combination with CSS then allows a styling adapted for different

devices. At the present time styling for mobile devices and print output are possible. This styling has not been implemented by us at the present time and remains at the discretion of the Marine Corps.

4. Transition Phase

During the Transition Phase we conducted extensive testing which is described in Chapter 5 of this document. This is also the phase where the system is deployed to the intended user, however, as of the writing of this document, we have yet to complete this portion. It is our intention to travel to Headquarters Marine Corps in Quantico, VA to present this project. It is our hope that the Marine Corps will find our site valuable and will host the site on its web servers. This is a secondary goal of this thesis, with the primary goal being to study how the Unified Process could be implemented in web site design. The success of our site within the Marine Corps is irrelevant to this thesis and is not covered here.

B. RISK ANALYSIS

1. Risk Management Plan

Our risk management plan can be summed up in the following:

- Identify Risk
- Assess Risk
- Assess Likelihood
- Determine Risk Mitigation
- Assess Final Risk Cost
- Adjust Project

To identify risk our team did some simple brainstorming. We simply tried to consider all risk scenarios and tried to pinpoint the risk involved. We researched available literature and based a lot of it on past personal experience. We immediately filtered those risks that were highly improbable. This is the area of risk assessment that can get completely out of hand. There is a seemingly infinite amount of risk in everything we do. There could be a lightning strike that could injure one of our team members down which would have a major consequence on this project but the likelihood is so minimal that it is not addressed. This philosophy prevented our team from getting too far off course with risks that were not going to affect this project.

To assess risk we looked at all of our listed risks and gave each risk a value. We used the following scale found in (Hall, 1998):

- Very Low: Risk is an inconvenience without serious impact
- Low: Risk has a minor impact to the process or product
- Moderate: Risk may disrupt the process or degrade the product
- High: Risk seriously disrupts or degrades a major part of the project
- Very High: Risk threatens failure of the project

It is crucial to any risk analysis to stay focused on the task at hand and not get ahead of the management plan. It is always tempting to disregard some risks because the mitigation plan is intuitive and easy to implement. However, the assessment stage is not the time to introduce mitigation but rather to stay focused on assessing the risk. For example, with this project we identified the security of our site as a risk. If someone broke into our site they could make unauthorized changes and disrupt the accuracy of the information provided. Displaying inaccurate information would make our site completely useless. Our team was quick to realize that our site would be placed on the official USMC web page which would make this type of attack unlikely. Although our site would not exist without the protection of the USMC server, this fact needed to be overlooked when assessing this particular risk. We had to assume the worst and simply assess the risk as if we were going to place our site on an open web server. The mitigation of placing it on a secure server would come later and should not be considered here.

To assess likelihood of occurrence for each risk we used the following scale (Hall, 1998):

- Chances are slight, highly unlikely, almost no chance
- Little chance, probability not unlikely
- Improbable, we doubt, better than even
- We believe, probably, likely
- Very good chance, highly likely, almost certainty

There are several different ways to assess the likelihood of occurrence of a risk. The best and most substantial involve metrics and using probability and statistics. This is best achieved on a project that already has a great deal of data to go with it. There is

usually a history of past risk assessments that can be applied to the current evaluation. In our case here we did not have such historical data to fall back on so we had to use our best estimation based on our own experiences.

The risk mitigation for our project came much the same way the risk identification came about. Our team simply brainstormed and developed what we felt would be possible mitigations for the risks we identified. Assuming the mitigation plan was implemented, we used the same scale as before to again determine the final cost of each risk. The mitigation will only have an effect on the likelihood and not the assessment. This is an important point to keep in mind. Identified risk that truly exists will always be risks to a project. The mitigation will only decrease their likelihood of occurrence but it will not diminish the risk. For example, if the risk of information security is identified and assessed to have a score of 5 on the assessment scale above. That means that we feel that a breach in the security of this system will have a very high risk and threatens failure of the project. We may believe that the likelihood deserves a 4 on our scale which means it is likely to occur if we do nothing to mitigate its occurrence. After putting in some measure to mitigate this risk we can significantly decrease the likelihood that this breach in security can occur however we have done nothing to lower the assessment score of a 5 on our scale. The risk of a breach in security remains high but we have just reduced the possibility of occurrence down to an acceptable level. This is the goal of our risk management plan.

After implementing our mitigation plan, we determine a final risk cost for the identified risk. This cost is the final probability that the risk will still occur. It is our goal to reduce all risk down to an acceptable level. The idea of an acceptable level is somewhat objective since risk acceptance can be so varied based on personal beliefs and the project's mission. The fact still remains that some risk will always remain and not all risks can be reduced down into an acceptable range. In these cases a decision needs to be made. The project plan can be adjusted based on the potential risk or the level of risk can be simply accepted. This decision rests with the project manager or the client but some level of risk will always exist.

2. Risk Analysis for Our Thesis

Our team gathered and did some brainstorming and identified several risks. We immediately discarded some of our identified risks based on the extremely low likelihood of occurrence. We settled on the following risks:

1. Finishing on time – we planned to finish this website by July 2006. There was a risk that we could get behind schedule and not complete this project on time.
2. Staying within budget – our thesis advisor gave us an allotted amount of funds that can be spent on a thesis. We will require TAD funds for some traveling to Quantico, VA. There is a risk that we could go over our budget.
3. Information Accuracy – the Marine Corps Uniform Regulations are constantly changing. This site needs to be updated as changes to the Uniform Regulations are approved and passed on to the fleet. We run the risk of having inaccurate information on our web-site if it is not updated appropriately.
4. Security of Site – the threat of hackers is always present when dealing with the internet. We have a risk of susceptibility to hacker attacks. If any user can break through and change any of the information on our website, it will sacrifice the integrity of the information posted. The information on this site needs to be in complete compliance with the Official Uniform Regulations Manual. Any deviations from this standard render this site useless.
5. Usability/Acceptance – We feel our biggest risk is that our intended audience, the Marines, will not use our website. If the information is not presented in a user intuitive and aesthetically pleasing manner, it will not be used.

We gave our risks the following assessment values:

1. Finishing on time: 3 Moderate: Risk may disrupt the process or degrade the product
2. Staying within budget: 2 Low: Risk has a minor impact to the process or product
3. Information Accuracy: 4 High: Risk seriously disrupts or degrades a major part of the project
4. Security of Site: 4 High: Risk seriously disrupts or degrades a major part of the project
5. Usability/Acceptance: 5 Very High: Risk threatens failure of the project

We gave our risks the following likelihood value:

1. Finishing on time: 3 Improbable, we doubt, better than even
2. Staying within budget: 3 Improbable, we doubt, better than even
3. Information Accuracy: 5 Very good chance, highly likely, almost certainty
4. Security of Site: 5 Very good chance, highly likely, almost certainty
5. Usability/Acceptance: 4 We believe, probably, likely

Our risk mitigation plan is as follows:

1. Develop a detailed timeline and stay on track. Timeline should be realistic enough to be managed but not have unnecessary delays.
2. We need to forecast all TAD costs. There is no cost to develop the site or use the server but there is cost for travel to Quantico VA.
3. We will pass this project off to the Marine Corps once we are done. It will be incumbent on them to keep the site up to date with the latest changes. We will need to ensure that the site's administrator is trained on this site. If this site is accepted as an official USMC website, it will be kept up to date since Marines will be using it as an official reference.
4. If we first assume that this site is placed on an open server, we feel it is highly likely that someone will try and succeed at breaking into the site and make malicious changes. Since we are going to put it in the USMC web server, we are certain of its security. This will provide the protection we need to prevent unauthorized changes.
5. We need to follow good HCI design and methods as illustrated in our HCI checklist. The principles of Human Computer Interaction will be fully explored with this thesis. The design will be IAW the principles of HCI and will support quick links and menu driven systems that will allow all relevant information to be displayed or hidden as the user requires.

After the implementing our mitigation plan we feel that that we have substantially reduced our risks and we continued our development with a much clearer direction avoiding some of the pitfalls that could have hindered the process.

C. CONFIGURATION MANAGEMENT

According to Wikipedia, Configuration Management is defined as “The control of changes--including the recording thereof--that are made to the hardware, software, firmware, and documentation throughout the system life cycle.” Configuration Management is the key to managing and controlling the highly complex software projects being developed today. Configuration Management tools have developed from simple version-control systems targeted at individual developers into systems capable of

managing developments by large teams operating at multiple sites around the world. In an uncontrolled site where multiple authors have access to edit and contribute, the potential for conflict and problems arise. One author may spend an entire day working on a particular file in the project and he may think that his changes are final. However, after these changes are made, another developer who works at home after hours, or in another office, may spend the night uploading their own newly revised version of the same file, completely overwriting the work of the previous author with no way to get it back. This is disastrous for project development and could be avoided with proper, and simple, configuration management tools. (Haas, 2002)

For this project, we developed our own tool for Configuration Management. Although our team was co-located during the development of this site, we did most of the work on the site at different locations, our homes. We may have been able to develop this site without developing this tool but for the purposes of this academic work, we felt it necessary to become familiar with Configuration Management and implement it in the development of this site. In keeping with the spirit of this project and our goal to become familiar with the software development process, we realized that Configuration Management is a crucial part of developing software so this type of experience would greatly benefit us as future software developers.

For our project we created our own Configuration Management tool that allowed us to individually work on the thesis but still provide version control and instant updates. We created a web based tool that is shown in Figure 9. Shown in Figure 9 is the main page of the Configuration Management site which we used throughout this project. In the center of the page we included a text area that details our timeline and any notes that we felt were necessary. Both team members had access to upload files and messages to the site which allowed us to communicate with each other while maintaining remote locations. This proved to be invaluable in the development of this project. On the left side of the page, we linked all versions of current documents that were required. We were able to assign tasks for any document to individual team members and that member would then upload the document to this site for other members to view. This was the strategy for using this tool and it follows the practices of Configuration Management as

described above. This also made it convenient for our advisors to view our progress and keep up with the latest versions of our documents and our uniform manual web site due to the tool being based on the web.

We also used the left side of the page to hold our documentation for the thesis write up. As we individually worked on chapters we could then upload them to the Configuration Management site and have them viewed and edited. The right side of the page was reserved for any links that we felt were related to our work.

Although the Configuration Management tool that we created for this project was quite simple, it did emphasize the importance of its use. We may have been able to develop this project without the use of such a tool since the team members were all centrally located here at NPS, but for our purposes in the academic environment the tool was invaluable. It provided us the convenience to work independently but at that same time it allowed us the assurance that our work was not being duplicated and would be seen by other team members.

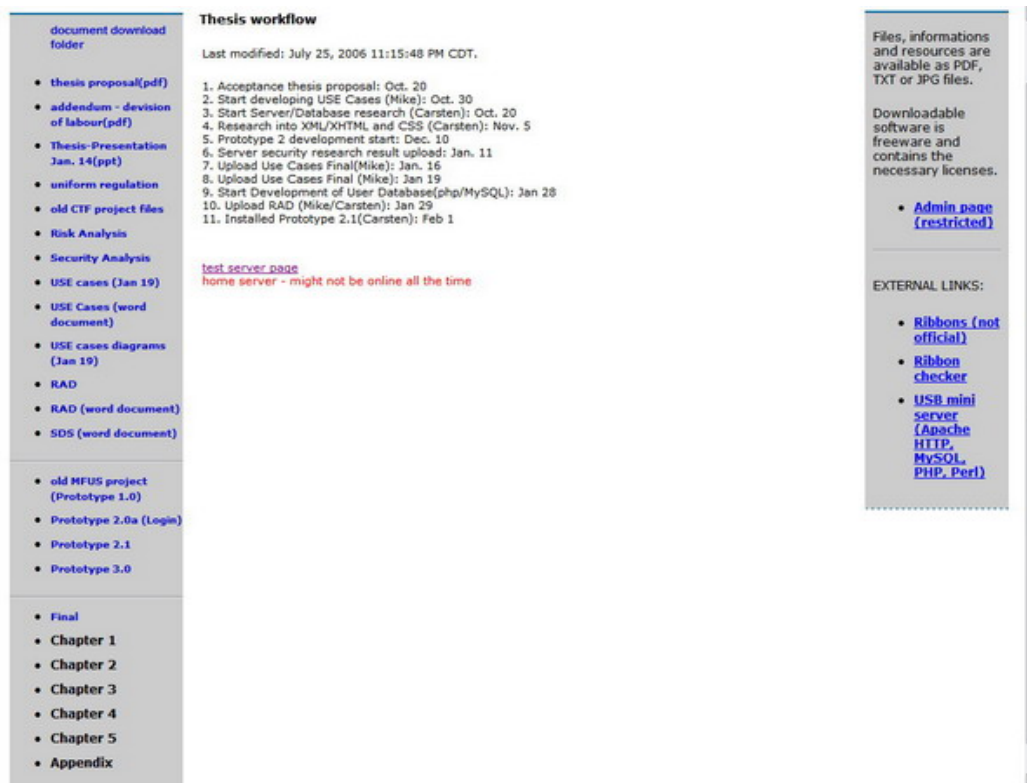


Figure 9. Configuration Management Website

D. EVOLUTION AND REUSE

This system has been designed in order to allow for easy maintenance. The designers of this system will not be responsible for any future maintenance of this system so it was our intention to build this site and turn all files over to Headquarters Marine Corps for implementation. Our design goal was to allow this site to be usable for many years to come within the Marie Corps. This can only be achieved if the site is easily maintainable and files can be edited or deleted as the MCO changes. In order to achieve the desired maintainability, the design must adhere to the following:

1. Reliability

The reliability of this system will be dependent on the stability of the code and the capacity for system upgrades. The design of this system has been done with the goal of system reliability in mind.

2. Efficiency

This system must be designed to maximize the efficiency of the code. This has been done by inhibiting overloading and preventing unnecessary parts of the code. All written code has been thoroughly scrubbed for gratuitous code or files.

3. Understandability

This will be a key aspect to maintaining this site. The documentation provided in the System Design Specification as well as the structure of the files will help future maintainers to understand the site and assist in implementing any changes. It is unknown as to the technical expertise and experience of the future maintainer of this site so full documentation is critical.

4. Measurability

Software metrics can be used to estimate the project budget and schedule, evaluate individual productivity and quality, evaluate project productivity and quality, and evaluate the system quality.

The design specifications for this system call for the design of a web based uniform manual for the United States Marine Corps. However, the same need can be paralleled to any service within the Department of Defense or any international military organization. This system has been designed with the concept of reuse in mind. The system developed here can be easily transferred into any other service branch with a file

structure that is generic enough to allow for the input of any uniform type and a system structure that can support any similar specification.

E. HUMAN COMPUTER INTERACTION

To facilitate an efficient system use and to guarantee user acceptance we needed a tool, a guideline, based on HCI principles. This guideline became a set of eleven categories for the visual and usability design. After reviewing several references, we developed the following categories that we feel are essential to successful web design:

1. Category 1: Simplicity

Simplicity provides the means by which the web page aims to keep the basic utility of the interface easy to use, and offer facilities which are of a clear value to the military member. The interface should be intuitive and there should be no question as to how to use this manual. We designed our site by mirroring the official USMC web page found at www.USMC.mil. The basic outline of this site is one that is well recognized by all Marines and it provided us with a simple template to follow.

2. Category 2: Consistency

The user should feel that he or she is in control and that the system is responding to his or her actions accordingly. Users should have control over the amount of information they receive at different points of the interaction. During the interaction, the web page should have a common look and presentation that is presentable and professional. As explained, the manual is broken up into four main categories; male officer, male enlisted, female officer, female enlisted. During exploration of this manual, each category is easily identified and allows for ease of presence within this site.

3. Category 3: Control

Control actions initiated by the user should receive the appropriate responses. Error and control messages should generate the same responses throughout this site. We allowed for the user to maintain complete control of the navigation and access of this site. We ensure that every link remains active and all areas of the site are easily navigable.

4. Category 4: Shortcuts and Customization

The web page should present mechanisms for users to customize settings to speed frequency of use by users. We accomplish this by allowing the main navigation bars to

be constantly visible and accessible by the user. This allows the user to determine his own outcome and retrieve his own desired information.

5. Category 5: Screen Layout

The screen layout should give an appearance of clarity with the proper use of white space to separate items. Items should be presented in a balanced fashion, and not distort during screen resolution change. This shall be achieved by the use of a “liquid design”. This “liquid design” guarantees that most or all functions and information are visible on all common PC monitor types and sizes. Additionally, control maneuvers should be reachable without scrolling extensively.

6. Category 6: Feedback

Appropriate feedback before, during, and after interaction is essential to proper HCI. Prompts and directions should be provided to the user at all times. The user should never be left in a state of question.

7. Category 7: Error Handling

There shall be no means of deleting or changing information. This action will allow the user freedom of experimentation without degradation of the information presented on this site. This will ensure error handling is at a minimum in regards to development of this site.

8. Category 8: Efficiency

All accessible elements of the web page are generated in a timely manner. To ensure an independence from the client device (and thereby allowing every web enabled client device to use this manual) all necessary data processing and code generation will be done by the server side. The information provided within this site is in conjunction with the latest regulation regarding the specific uniform in question. In an effort to speed efficiency, a “SEARCH” feature should also be implemented. The added feature will allow expert users extended usability of this manual.

9. Category 9: Help Facilities

The web page will provide a mechanism to report problems or errors. Additional help facilities regarding military uniform regulations will also be provided. The current version of our site does not include a “help” function but it could be implemented if required by the Marine Corps.

10. Category 10: Navigation

Navigation within the web presence should be easily achieved with minimal “clicks” or drop down menus to achieve a desired result. We feel that this is clearly demonstrated in our site. We focused intently on providing the required information in the most expeditious manner. The written uniform regulation manual contains an enormous amount of information that is extremely difficult to comprehend. One of our primary goals was to allow easy navigation and we feel like we accomplished this with this site.

11. Category 11: Objects

Each major category will have similar index pages and file structures. The objects that will be created from the index page as the user completes a search for desired information are shown in Figure 10. Generic layouts for other pages are shown in Figures 11 and 12. These are not objects as normally recognized in object oriented programming, but we refer to them as objects for explanatory purposes. Since this entire system is web based, objects are not truly created but rather each selection calls a desired page within the web server.

Navigation Bar	
Home Uniforms Grooming Awards Rank Insignia Civilian Clothes PT Gear Organizational Musical Units	
Member Info Male/Female Rank	Main Photo Area
Contact Info Help Manual	
Links	Detailed Text from Marine Corps Order P1020.34G MCO

Figure 10. Index Page Layout

Navigation Bar Home Evening Blue Dress Blue/White Dress Service Utility	
Links	Main Photo Area
	Detailed Text from Marine Corps Order P1020.34G MCO

Figure 11. Typical Uniform Page Layout

Navigation Bar Home Evening Blue Dress Blue/White Dress Service Utility		
Optional Items	Main Photo Area	Detailed Sections
Detailed Text from Marine Corps Order P1020.34G MCO		

Figure 12. Typical Uniform Type Page Layout

IV. FORMAL TESTING

A. INTRODUCTION

Our most valuable learning point throughout our entire thesis work is the importance of testing when developing software. The strict Unified Process that we mirrored in this web site development calls for a formal testing phase consistent with the iterative process. We realized early on the value of proper and in-depth testing in the overall success of our system. We did not want to fall into the trap of not leaving enough time for solid testing and we did not want to leave testing as an after-thought. We built into our timeline for the development of this system plenty of room for a thorough testing phase to include the time needed to implement the changes learned from our testing and then re-testing the site with those changes. What we did not fully realize was that testing of a system is not just limited to the formal testing phase.

Throughout the development process of this system, we have been conducting “informal” testing. There are many levels of testing that a system goes through while it is being developed. During the inception phase, we tested the soundness of the general idea and scheme that we envisioned for this system. Figure 13 shows our original flow chart from our Requirements Document that shows the flow of information as we planned in the inception phase. We devoted a lot of time in developing this flow chart because we knew that it would be the foundation to the entire development process. We conducted our own test and evaluation of our flow chart just amongst our development team which proved to be invaluable to allowing us to fully understand our plan for information flow and it clarified our vision of the entire layout of our system.

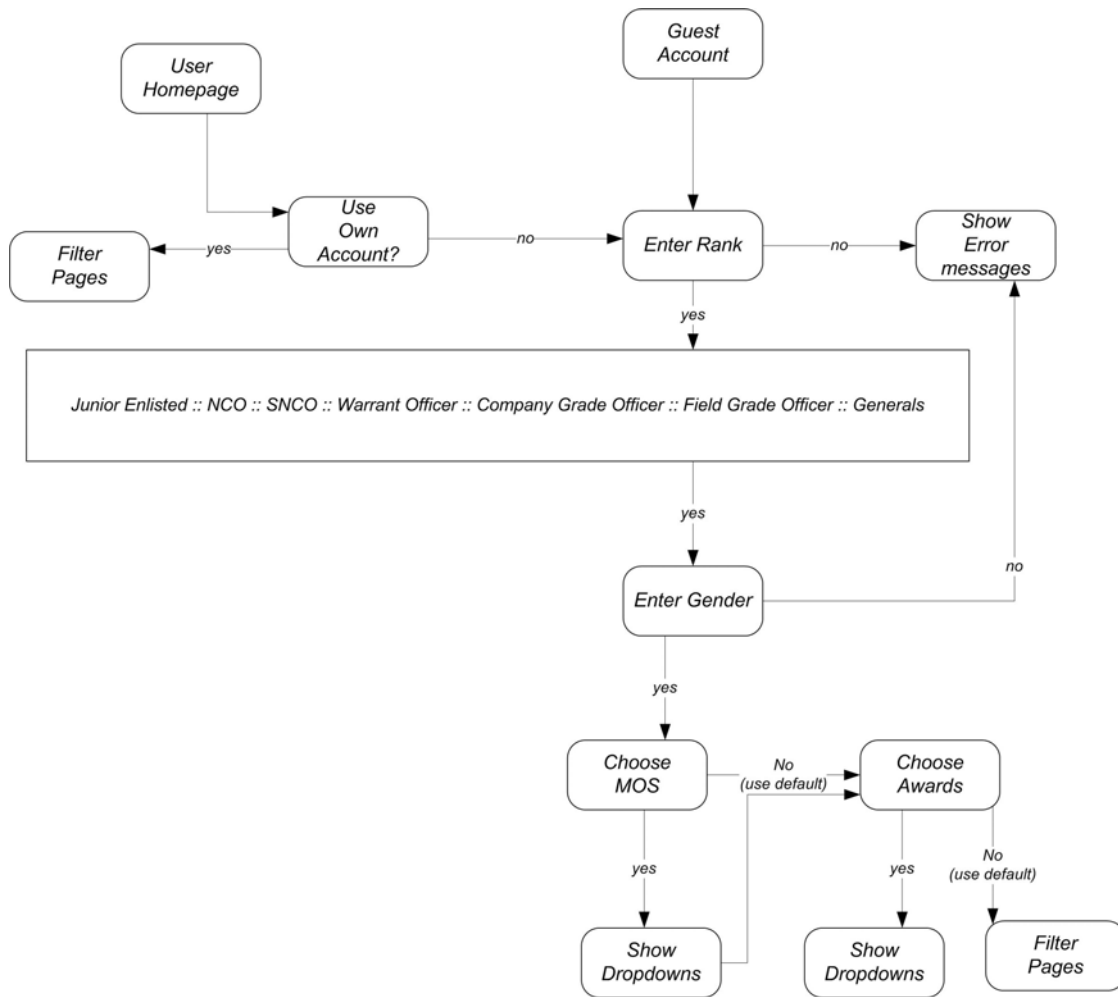


Figure 13. Flow chart

We used several tools for this type of “informal” testing including flow charts and prototypes but we also relied on basic trial and error as we designed the site. We constantly had a local server running on the computer we used to program the design and we simply would view pages as we created or changed them for instant feedback. This type of on-demand testing along with other informal testing methods proved extremely important in the overall development. We set our own standard for this system and we did not move forward until we were satisfied with the design at that point. As we moved into the formal testing phase, we were much more confident that our system would test well with our subjects because it had already passed our own testing standards. This “informal” testing was much more ad-hoc and specified as compared to the formal testing but it saved us a tremendous amount of time in the overall process.

For our formal testing phase we used a usability lab provided by Dr. Ciavarelli. The lab consisted of two lap top computers, three cameras, and a voice recorder. The test computer was used by our subjects and we used the observation computer to monitor and run the tests. The test computer was loaded with a local server which housed our entire site. One camera was placed at eye level to record the test subject's eye movement while looking at our site. The second camera was positioned to record the subject's hands on the keyboard to record keystrokes and mouse movement. The third camera was set to capture the profile view of the subject in order to capture head movement. We used the voice recorder to allow the subject to orally detail their thoughts and critiques and to allow instant feedback. We felt this was much more effective than having the subject go through the site and then write down their comments afterward. Getting the instant voice recording prevents the problem of subjects having to recall their thoughts after the test is completed and avoids the nuisance of having to write down the information. Oral feedback allows the subjects to speak freely and openly and they are more likely to provide detailed comments than if they had to write their thoughts down. We did have the subjects complete a survey as found in Appendix IV but this was a short concise survey that was simply used to consolidate the test results from each subject. The voice recordings were used to provide detailed information that we could go back to and make the changes as suggested.

B. TEST 1

Our first test was conducted with five subjects all of which were male Marine officers currently enrolled in the Computer Science curriculum at the Naval Postgraduate School. These subjects had between 10 to 17 years of experience in the Marine Corps and all possessed high levels of technical skills. They were all very familiar with the current Marine Corps Uniform Manual and they were all familiar with our project through informal conversations with our team while we were developing this system. All of the subjects were hand selected by our team because of these qualifications. We knew this was a specialized group for testing and they would provide uniquely tailored responses and feedback. Since this was our first attempt at testing this system in a formal setting, we wanted to have a controlled environment with a group of selected subjects that had a high level of familiarity in order to validate our own evaluation of this site.

Our team felt that the site was well formed and very close to a final product before we began testing but we needed to corroborate this with our subjects.

The usability lab was set up as described above with two computers, three cameras, and a voice recorder. The subjects were asked to follow a written scenario (Appendix IV) provided by our team. The scenario was intended to provide a common baseline in order for a sound comparison to be done on all five subjects. The questions on this scenario asked the subjects to find various uniform requirements and we attempted to derive questions that users may ask of this system. The actual answers to these questions were not as important as simply giving the subjects some direction so they would have to navigate through a large portion of the site. We felt that if we just had our subjects browse our site as they wished, they may not thoroughly navigate the site and they would not be able to provide us useful feedback. All five subjects gave us instant oral feedback and they all completed our survey for a written record of the test. These completed surveys are provided in Appendix IV.

This first round of formal testing proved to be quite successful. We learned that, overall, our web site was progressing as our team had assessed. The HCI design principles described in Chapter 3 of this document that we attempted to follow showed an initial successful implementation. The subjects gave us positive feedback on the overall navigation of the site and the layout of the pages to include color and font. We designed our site to be consistent in structure and aesthetics with other Marine Corps sites that are currently available on the web. Some of the subjects immediately commented on that fact and stated that they felt like they recognized the layout and instantly felt comfortable with the structure. All of the subjects suggested that we implement a “search” function to allow a user to more quickly find desired information. We agreed with this assessment but we will leave the implementation to the Marine Corps. We received several other suggestions for some minor changes that we were able to quickly implement due to the simple file structure that was used when designing this site.

A very important point that we learned during this initial phase of testing was that we were able to test our testing procedures themselves. In this instance, both of our team members sat side by side with the subjects as they were testing the site. This made it

very tempting for our team to steer the subjects around the site and offer suggestions while navigating. We also found ourselves explaining away some of the critiques being offered by the subjects. Of course, this type of input skews the results of the testing and makes it difficult for subjects to objectively evaluate the site. The usability lab has the capability to conduct remote testing with the observer computer placed in a separate location from the subject. We will implement this in our next phase of testing to avoid the temptation of helping the subjects with using the site. The subjects did find that the scenario driven questions did prove to be very useful in keeping them moving within the site. This was only successful by having the subjects speak aloud while they were attempting to answer the questions provided and they felt free to make any comments while searching. The running dialogue proved to be the most useful information provided during testing. The subjects were encouraged to speak freely, regardless of how minor their critiques seemed. Some suggestions were beyond the scope of this project but most were implemented.

C. TEST 2

For the second round of our testing we focused on testing female Marine officers. After receiving the feedback from the male Marine officers during the first test, we felt that we could build the entire site and complete all of the navigation for “Male Enlisted”, “Female Officer”, and “Female Enlisted”. We felt that the male officer subjects used in the first round of testing gave us an adequate representation of that gender and rank so we decided that we needed to target other audiences. The female subjects used for testing were all female captains but ranged in experience from 10 years to 15 years. Given our current location here at NPS, we are limited to the number of female officers from which to choose but we felt it crucial to have the site evaluated from a female officer perspective.

Since the site was working in its entirety for this portion of the testing, we needed to adjust the scenario provided to the subjects for testing. The scenario is provided in Appendix IV. This scenario now required the subjects to navigate the entire site to include switching between different ranks and genders. The challenge here is that since the site is now four times as big as it was during the first round of testing, it is very difficult to have the subjects visit a large portion of the site. We found that it was crucial

to keep the testing scenarios short in order to keep the interest level of the subjects high and provide valuable feedback. If the testing lasts too long, the subjects tend to lose interest and they feel that the testing has now become a burden. This would negatively affect the feedback provided by the subjects and would degrade the value of the testing. Our challenge then becomes to design a scenario that requires the subjects to navigate through as much of the site as possible but complete the testing in a limited time. The scenario in Appendix IV was completed in only 20 minutes by the subjects but it does drive the users to each rank and gender of the site.

D. TEST 3

For our next round of testing we focused on enlisted Marines of both female and male gender. At this point we had tested the site on both males and females and we were able to make adjustments to the site as necessary. We were confident in the navigation of the entire site and we made adjustments to maximize the functionality. Our previous test cases hardened our resolve in the usability of the site but we still felt that we needed to test for the accuracy of the information provided within the site. Thus far we used strictly Marine officers so we shifted our test subjects to enlisted Marines. This proved to be the most valuable round of testing completed.

All of the test subjects were found at the Defense Language Institute at the Presidio of Monterey. They were all enlisted Marines, both male and female, ranging in rank from Private First Class to Corporal. Their years experience ranged from 4 months to 4 years. The most surprising detail of their background was that they had a wide range of technical experience. This was unlike the Marine officer subjects of the previous rounds of testing who were all Master's degree students and all possessed a high level of technical skill and computer savvy. The enlisted subjects ranged from web designers to complete computer novices with very little web surfing experience. We were extremely surprised to find such a high level of computer experience with some of the subjects conversing at the technical level as to the file structure and design of the site. However, we were equally surprised to discover that some of the subjects clearly had a fear of using computers and were complete novices to surfing the web and looking at web sites. We

became quickly convinced that the audience of potential users of this site is much more diverse than originally estimated and this round of testing would truly stretch the limits of the structure and design of the site.

After the first few subjects completed their testing, we found it necessary to adjust the scenario driven testing. The scenarios provided in Appendix IV proved successful in the first two rounds of testing but were actually limiting the subjects during this third round of testing. What we found is that the enlisted Marines were too focused on the answers to the questions provided and were not providing enough feedback on the site itself. It seems that the enlisted Marines are so driven to complete any task given that they become blindly focused on completing that task. We tried to emphasize, as we did the male and female officers that the scenario is only provided to allow them some guidance to navigating the entire site but that it was not intended to be a test of their knowledge of the uniform manual. For example, the question “What is the hem size on a male enlisted Service Dress C?” was only provided to require the subjects to navigate within the male enlisted sub-site. The answer to the question was not at all important, we just wanted to provide the subjects some guidance to ensure that they were not just aimlessly browsing the site. The enlisted Marines became narrowly focused on answering the questions provided and lost sight of our true intentions and the reasoning behind the scenario driven testing.

Our solution to this problem was to have the subjects create 5 questions of their own regarding the USMC uniform regulations. They then stated their question out loud before proceeding and they were required to find the answer to their question using the web site. This actually turned out to be extremely beneficial to the feedback received since this was much more closely resembled the way this site would actually be used. We anticipate users desiring to gain some information about their own uniforms or about a particular rank and gender and then using our site to find the answers. This new testing strategy prevented the users from being so narrowly focused on answering our questions and allowed them to use the site in a realistic way. This had the positive effect of allowing the users to provide us commentary on the site’s design, functionality, and accuracy of information, which is the purpose of testing.

The feedback provided from this round of testing proved to be invaluable. We were able to confidently adjust the site to be usable for a much wider range of users. The site became structured to accommodate male Marines as well as female Marines, officers and enlisted, and Marines new to the Marine Corps as well as very experienced Marines. But the most valuable lesson learned from this round of testing is that our site tested to be usable to the computer savvy Marines as well as for the Marines with very limited computer expertise.

V. CONCLUSION AND FUTURE RESEARCH

In conclusion we felt that we had a very successful thesis project. We were able to accomplish our goals presented in Chapter I while learning much more than we initially anticipated. Although it was not our original intent, we have become experts with the current Marine Corps uniform regulations manual. This is due to the fact that we were required to thoroughly evaluate the current manual in order to implement it in an easy to use web site. We needed to be precise on the requirements for wearing all uniforms and their accessories in order to provide the users with completely accurate information. In our research we found numerous contradictions and errors with the current manual that required the attention of the official United States Marine Corps Uniform Board. They are responsible for maintaining the regulation and ensuring its accuracy. They were pleased that we were attempting to build this site for their use and it is with this board that our team will deliver the final product. An example of one such discrepancy is there is currently a contradiction in the manual as to the wearing of the male all weather coats. In one section of the manual it states that the all weather coat could be optionally worn with the Evening Dress uniform. However, that statement is contradicted later in the manual with the statement “The AWC may be worn or prescribed for wear with the service, dress, and utility uniforms.” There is no mention of the Evening Dress uniform. These types of errors were independently corrected with the uniform board for accuracy.

We conclude that following the Unified Process for web development definitely led to the successful completion of such a complex web site. Following such a process allowed us to focus during the development of this site and it narrowed our center of attention to the tasks that allowed us to progress to a finished product. We spent a considerable amount of time up front in the Inception Phase and the Elaboration Phase which paid off during the Construction Phase. It was very tempting for us to shorten the first two stages and dive deeply into constructing the site. The temptation to do this was caused by the fact that it is in the Construction Phase that the goal of creating the site is attained. We made a concerted effort to follow the guidelines of the process and used the tools provided to create a detailed plan with which to follow before writing any code.

Since this is an iterative process, we did take advantage of the flexibility that allowed us to fluctuate between phases and stay within the bounds of the framework.

Although we are convinced that the Unified Process is an excellent tool to use when developing a complex web site, we are still uncertain about the efficiency of using such a process. It is difficult to say whether we could have developed this same site in a shorter amount of time having used a different process or no process at all. There were many factors that drove our schedule and leave some doubt as to the efficiency of the process.

One of our team members did have some prior experience with web development and design but nothing as complex as the site for this thesis. His style was much more ad hoc with no set process followed as most web designers are inclined to do. Neither one of us had any experience with developing software with the Unified Process. We had been exposed to the process in theory while here at NPS, but we had no practical experience. We found ourselves learning the process while we were actually implementing its practices. This fact leads to our doubt as to the time needed to complete this site. Were we slowed down because we were not fully comfortable with using the Unified Process or were we slowed down because the Unified Process is not designed for web site development? We conclude that the former is more accurate rather than the latter but future attempts at this same type of development would give a definitive answer.

**APPENDIX. WEB BASED UNIFORM REGULATIONS MANUAL
SUPPORT DOCUMENTS**

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I. REQUIREMENTS ANALYSIS DOCUMENT (RAD)

A. REVISION SHEET

[illegible]

B. INTRODUCTION

1. Purpose

The purpose of this Requirements Analysis Document (RAD) is to define the requirements for the Web Based Uniform Regulations Manual and to present them to the customer for review, comment, and validation. The RAD includes a flow chart of information paths, Use Case Diagrams, Use Cases, System Sequence Diagrams, a list of the required options for the home page along with a detailed diagram of each selection, and a decision tree to visually display the options necessary to choose a uniform display.

2. Background

The current United States Marine Corps Uniform Regulations, titled Marine Corps Order P1020.34G, is available in hard copy or on-line in PDF format only. There is not a Graphical User Interface system currently in existence for this information, and in

its current form, traversing this document can be a tedious process and time consuming. As with most military manuals of its kind, was not written in a user intuitive manner.

Major issues/concerns with existing manual:

- The current manual requires multiple pages to be repeatedly referenced before being fully understood.
- Verbiage can be distracting and cause regulations to be misunderstood.
- It does not provide a “quick reference” for user convenience.
- Changes to regulations require entire manuals to be generated and replaced, leading to older versions with outdated materials still in circulation.
- Not written to be “user intuitive”.
- Even experienced users can have problems quickly accessing the information they require.

3. Scope and Audience

The web based manual described in this document will be in strict accordance with MCO P1020.34G. This system will be relied on by Marines world wide as an accurate source of standards that ensure their compliance with the MCO. The new design will be IAW the principles of HCI and will support quick links and menu driven systems that will allow all relevant information to be displayed or hidden as the user requires. The new system will address all aspects currently outlined in the regulations, such as proper wearing of the uniform, grooming standards, ribbon and medal precedence, civilian attire, PT gear, and optional items for male and female officers and enlisted U. S. Marines. This system could be used by all US civilians and military service members to whom the current manual is now relevant.

4. References

- Bruegge, Bernd. *Object-Oriented Software Engineering*. Pearson Prentice Hall, Inc. 2004
- Larman, Craig. *Applying UML and Patterns: an introduction to object oriented analysis and design and iterative development*. Pearson Education Inc. 2005.
- Hall, Elaine M. *Managing Risk*. Addison – Wesley. 1998.

C. GENERAL DESCRIPTION

1. Product Perspective

The overall goal of the project will be to create an easy to use web based uniform regulation guide in accordance with Marine Corps Order P1020.34G.

2. Product Function

The guide will be implemented using primarily visual aides and follow the practices of good Macro/Micro HCI Design. The aim will be to provide the needed information to the user in an easy to use GUI interface that requires minimal “mouse clicks” to retrieve the desired information. The guide will also provide the user with alternative text from the current MCO dealing with the specific uniform in question. The end result will be an easy to use research tool that may be utilized by military members of the United States Marine Corps as well as any person requiring specific uniform regulations.

D. USER ANALYSIS

The challenge of the project design lies in the fact that the user population is widely varied in education (civilian and professional), computer savvy, age, and cultural background. Interaction with the GUI interface to the system needs to be intuitive for the user with a high school background and minimal computer skills while simultaneously not alienating the more educated user population. Additionally, implementing multimedia suitable and appealing for both the young and older users will prove arduous. Finally, in order to avoid confusion, we must be vigilant in our usage of terminology (especially acronyms) that is only prevalent in certain cultures.

1. User Characteristics

The expected users of this system include all members of the U.S. Marine Corps as well as any other military members desiring information regarding Marine Corps uniforms. Users may also include civilians requiring the same information.

2. User Experience

The expected users will range from Marines with very little military experience to career Marines whom have dedicated a lifetime to the Marine Corps and are well versed in the current uniform regulations as well as passed versions of the manual. This system must satisfy the needs of a Marine who is new to the Marine Corps as well as the veteran. It is vital that the information provided be accurate and correct in order to prevent the user from wearing a uniform or uniform item against current policy.

3. User Skill Level

This system will incorporate simplicity within its design. The initial design will be under the assumption that the user has basic computer operating skills and web browsing capabilities. Where applicable, the system will hide system complexity from the novice while simultaneously appealing to the expert user.

4. Other Needed Skills

No additional skill sets are assessed as being required for successful operation of the system. The majority of interaction the user will have with the system will involve “point and click” functionality.

E. FREQUENCY OF SYSTEM USE

We envision the system being used on a daily basis by thousands of service members and civilians worldwide. However, the average individual user will likely only visit the site weekly or biweekly.

F. ASSUMPTIONS AND DEPENDENCIES

The following are assumptions and dependencies identified for successful and timely completion of the requirements specified herein.

- No major loss of engineering personnel
- No major changes in requirements once the documented requirements contained within this RAD are approved
- Availability of test personnel
- Individuals are familiar with web browsing on their specific systems

G. SYSTEM FUNCTIONALITIES

1. System Set-Up

The Boundary Use Cases shown in Section I identify the necessary set up required for initial system functionality. These Boundary Use Cases are further detailed with the accompanying sequence diagram in Section K. The Boundary Use Cases can be summarized as follows:

- The system must allow an administrator to put a new file into the system.
- The system must allow an administrator to edit user accounts stored in the database.

- The system must allow an administrator to add or remove an award from the database.

2. System Operations

The following are major system operations derived from the use cases displayed in the Use Case Diagram in Section I and described in Section J:

- Prospective should be able to create a user name and password to access the site and set account information.
- Prospective should be able to log-in to the system with a user name and password or enter the system as a guest.
- Prospective user should be able to update account information that is currently stored in the data base.
- User should be able to search for a uniform authorized for own rank.
- User should be able to gather information and photos on uniform regulations for ranks or genders other than his own.
- User should be able to access grooming standards for a male or female.
- User should be able to see awards displayed in order of precedence for their own awards or entered awards.
- User should be able to view regulations for civilian clothes.
- User should be able to view regulations for Physical Training (PT) gear.
- User should be able to view regulations for organizational clothing.

H. SYSTEM ATTRIBUTES

This system will function as a web server capable of displaying interactive pages to a user with containing text as well as images. The web server will need to interact and exchange information with a database which will hold user account information as well as images to be used and displayed by the server at the request of the user. Section K shows high level sequence diagrams that illustrate the interaction between the user, the system and the database for the Use Cases given.

The flow charts found in Section L show the paths that could be selected by the user and must be handled by the system. Section M shows the functionality of the home page of the system and illustrates all choices required by the user. This system must provide the user with all available information found in the MCO and the home page will

be the central point of distribution. All selections from the home page spawn several different information paths that must be handled by the system.

I. BOUNDARY REQUIREMENTS

1. Boundary Use Case Diagram

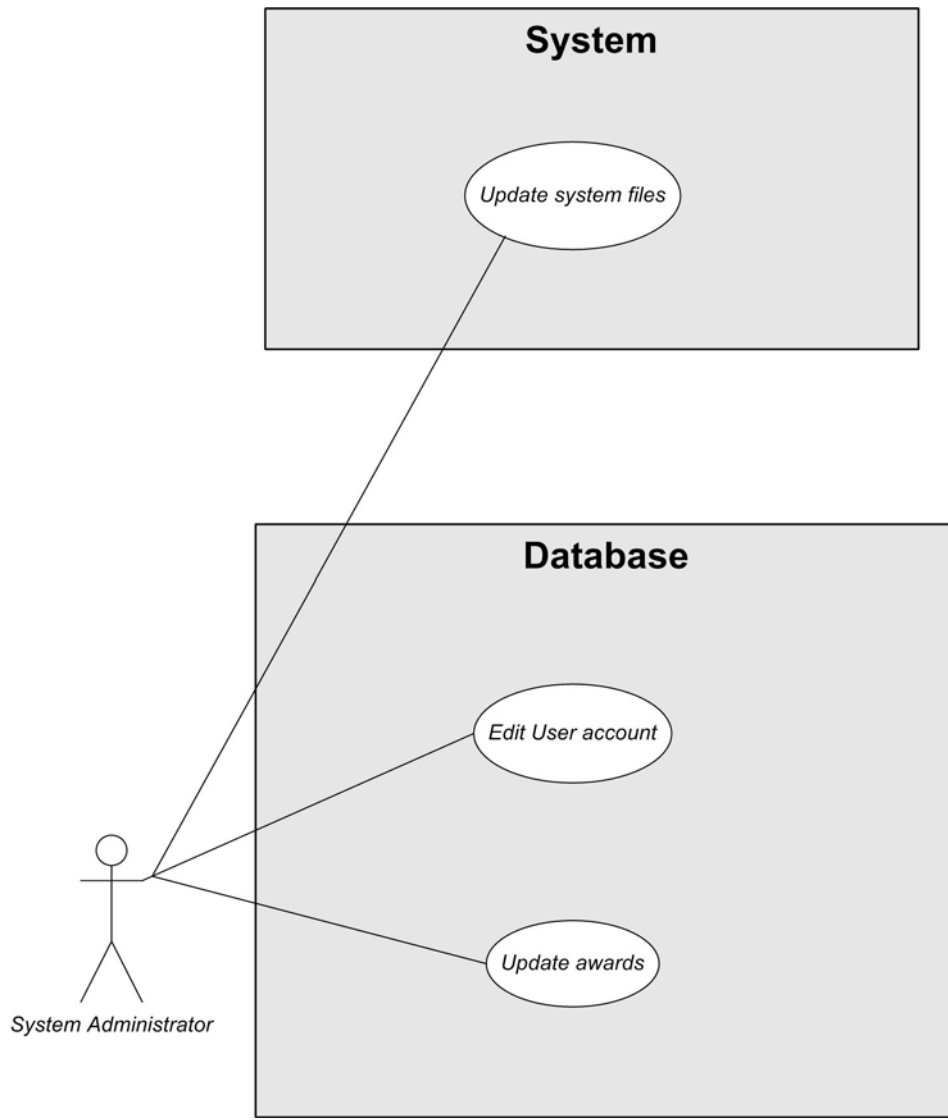


Figure 1. Boundary Use Case Diagram

2. Boundary Use Cases and Sequence Diagrams

These boundary use cases describe how the system will be initialized. They include the construction of the system files and also all data base input.

Boundary Use Case: BUC-1 Update System Files
Primary Actors: System Administrator

Stakeholders and Interest:

1. The system administrator has created a file and desires to put the file into the system. The system administrator will be required to pass an identification and authentication security requirement in order to edit or replace any files.

Entry conditions:

1. The system is operational and the file is in the correct format.

Exit conditions:

1. The system makes the new file available and the new file is properly linked within the website.

Flow of events:

1. The system administrator is correctly identified and authenticated, gaining access to the system's file manager.
2. The system administrator places the desired file into the system's file structure either through the file transfer protocol (FTP) or another available method.
3. The system administrator logs off of the system, ending the update session.
4. The system maintains a log of all events during this session.

Exceptions:

- *. System is unavailable. System shows error message.
 - 1a. The system administrator does not provide an authorized identification or password.
 1. The system shows an error message and allows for another attempt.
 2. Repeat this for a total of three times before system locks for 30 minutes.
 - a. System updates log of failed attempt.
 - b. System allows the update capability to be restored after 30 minutes.
 - 2a. The system administrator desires to update or edit an existing file.
 1. The system administrator locates the desired file.
 2. The file is opened and changes are made.
 3. The file is saved in the system with new changes.
 - 2b. The system administrator desires to delete an existing file.
 1. The system administrator locates the desired file.

2. The file is deleted from the existing files.
3. The system updates its file structure.

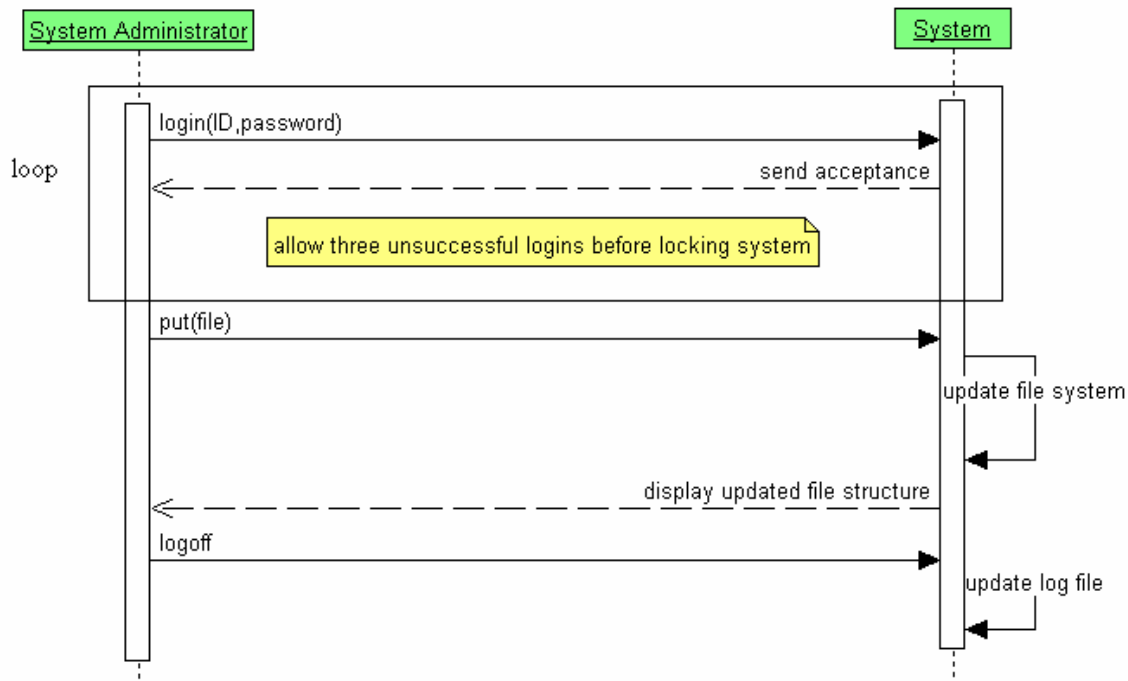


Figure 2. BUC 1

Boundary Use Case: BUC-2 Edit User Accounts

Primary Actors: System Administrator

Other Actor: Database

Stakeholders and Interest:

1. The system administrator desires to edit user accounts stored in the database. Most user accounts will be created and edited by users as in UC-1 and UC-3. A system administrator will also have the ability to edit user accounts.

Entry conditions:

1. The system is operational and the database is accessible.

Exit conditions:

1. The database is updated with the new information or the information is properly deleted from the database.

Flow of events:

1. The system administrator is correctly identified and authenticated, gaining access to edit the database via an administration tool.

2. The system administrator uses the administration tool to add new user account information.
3. The changes are saved on the database and the database is updated.
4. The system administrator logs off of the system, ending the update session.
5. The system maintains a log of all events during this session.

Exceptions:

*. System is unavailable. System shows error message.

- 1a. The system administrator does not provide an authorized identification or password.
 1. The system shows an error message and allows for another attempt.
 2. Repeat this for a total of three times before system locks for 30 minutes.
 - a. System updates log of failed attempt.
 - b. System allows the update capability to be restored after 30 minutes.
- 2a. The system administrator desires to update or edit an existing user account.
 1. The system administrator locates the desired account information.
 2. The changes are made.
 3. The database changes are saved and the database is updated.
- 2b. The system administrator desires to delete an existing user account.
 1. The system administrator locates the desired user account.
 2. The account is deleted from the database.
 3. The database changes are saved and the database is updated.

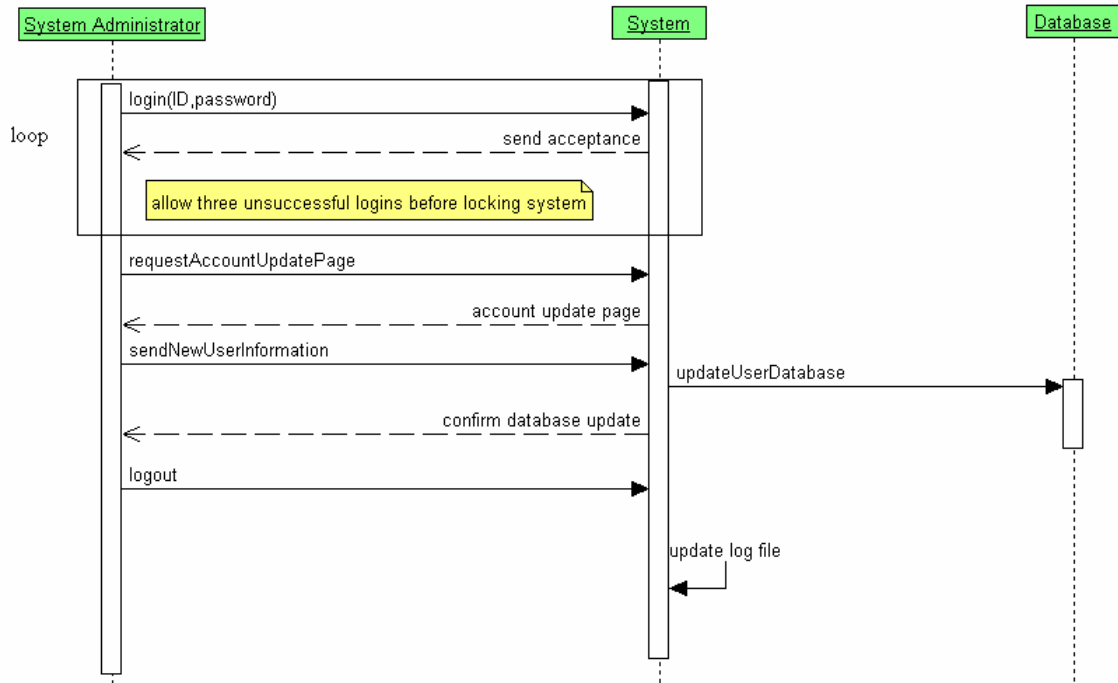


Figure 3. BUC 2

Boundary Use Case: BUC-3 Update Awards Stored on Database
Primary Actors: System Administrator
Other Actors: Database

Stakeholders and Interest:

1. The system administrator desires to add or remove an award from the database. The database will store photographs of all Department of Defense approved awards. The database will need to be initially populated with authorized awards. As new awards are authorized, the database will need to be updated.

Entry conditions:

1. The system is operational and the database is accessible.

Exit conditions:

1. The database is updated with the new information or the information is properly deleted from the database.

Flow of events:

1. The system administrator is correctly identified and authenticated, gaining access to edit the database via an administration tool.
2. The system administrator uses the administration tool to add a new photograph of a DOD approved award.
3. The changes are saved on the database and the database is updated.
4. The system administrator logs off of the system, ending the update session.

5. The system maintains a log of all events during this session.

Exceptions:

*. System is unavailable. System shows error message.

- 1a. The system administrator does not provide an authorized identification or password.
 1. The system shows an error message and allows for another attempt.
 2. Repeat this for a total of three times before system locks for 30 minutes.
 - a. System updates log of failed attempt.
 - b. System allows the update capability to be restored after 30 minutes.
- 2a. The system administrator desires to delete an existing award photograph.
 1. The system administrator locates the desired photograph.
 2. The photograph is deleted from the database.
 3. The database changes are saved and the database is updated.

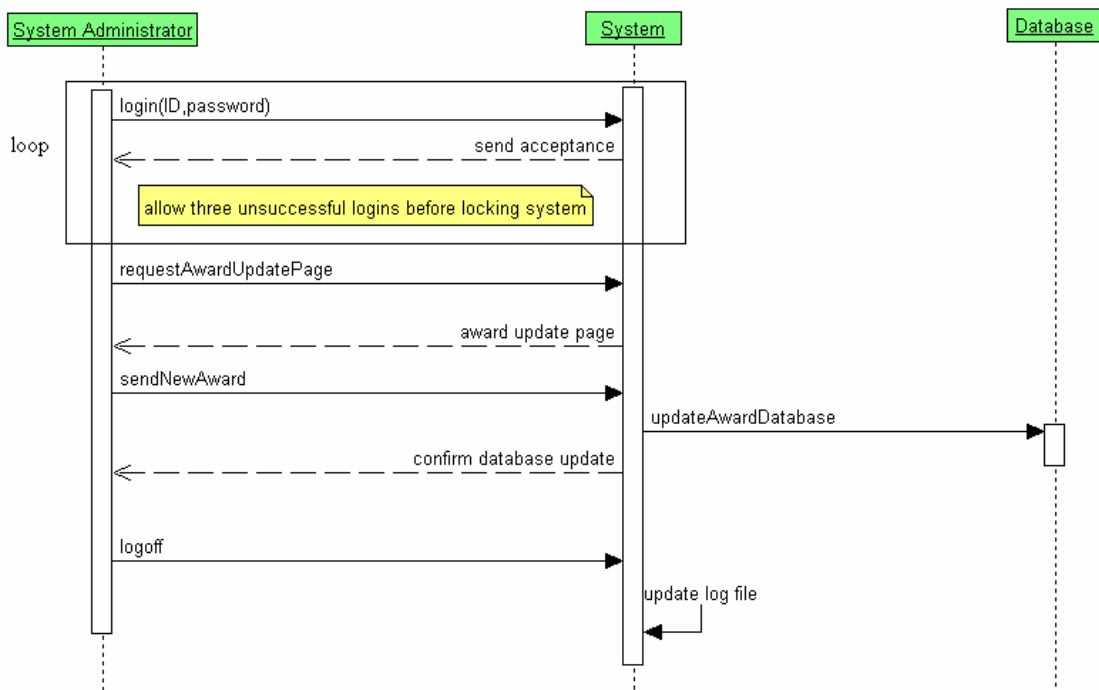


Figure 4. BUC 3

3. Use Case Diagram

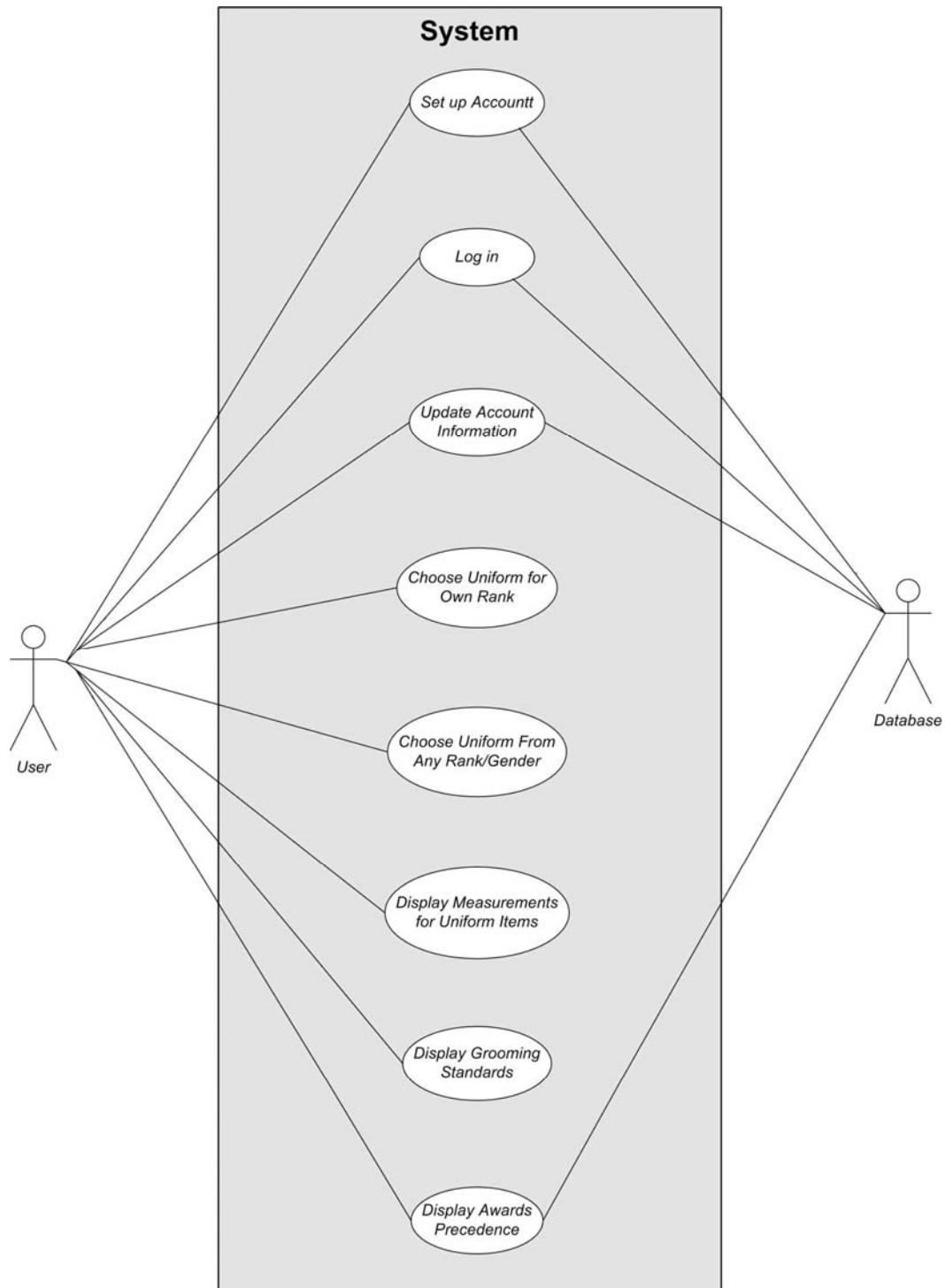


Figure 5. Use Case Diagram

J. USE CASES

Use case: UC-1 Set Up Account

Primary Actor: Prospective User

Other Actor: Data Base

Stakeholders and Interest:

1. Prospective user wants to create a user name and password to access the site and set account information.

Entry conditions:

1. System is operational.
2. Prospective user has access to the internet and the system is accessible.
3. Prospective user has correctly entered the URL into a browser and the system has responded with the log in page.

Exit conditions:

1. Prospective user completes the required account information inputs and is sent a verification of account set up by the system.

Flow of events:

1. Prospective user selects the new user link from the log in page.
2. System displays the account information page with required input fields.
3. Prospective user fills in the account information.
4. Prospective user submits account information.
5. System updates internal database with new information.
6. System sends a verification of a successful account set up.

Exceptions:

*. The prospective user cancels the procedure at any time. All the data are purged from the system.

- 2a. Page is not available to be returned to the user.
 1. System displays an error message.
 2. Repeat step 1 in flow of events.
- 5a. System rejects application due to inadequate information.
 1. System directs Prospective user to complete affected areas of application.
 2. Repeat step 3 in flow of events.
- 5b. System rejects application due to duplication found in user name.
 1. System directs the Prospective user to use a different user name for this account.
- 6a. System fails to send a verification message.
 1. Repeat step 1 in flow of events.

Use case: UC-2 Log-In
Primary Actors: Prospective User
Other Actor: Data Base

Stakeholders and Interest:

1. Prospective user wants to access the system.

Entry conditions:

1. UC-1 completed.
2. System is operational.
3. Prospective user has access to the internet and the system is accessible.
4. Prospective user has correctly entered the URL into a browser and the system has responded with the log in page.

Exit conditions:

1. User has successfully logged in to the system.

Flow of events:

1. User enters user name and password in order to access the system.
2. The system validates the entered information.
 - a. In case data is invalid: Inform the customer and proceed to step (2)
 - b. In case data is valid:
 1. System displays the home page.
 2. Personalized welcome message displayed on home page.
 3. System filters all information according to account information such as rank, gender, awards, etc.

Exceptions:

- *a. Customer is locked out after three (3) unsuccessful attempts to log-on.
- 1a. User forgets user name or password.
1. User selects the forgotten user name/password link.
 - a. System sends a blank information page with inputs for:
Last Name
First Name
Rank
Gender
E-Mail address
User Name
Password
 - b. User must input at least four fields.
 - c. System verifies these four fields.
 1. If the fields verify successfully, system e-mails user name and password to e-mail address.

2. If the fields cannot be verified, the system notifies the user.

Use case: UC-3 Update Account Information
Primary Actors: Prospective User
Other Actor: Data Base

Stakeholders and Interest:

1. Prospective user wants to update his account information that is currently stored in the data base.

Entry conditions:

1. UC-1, Set Up Account, completed.
2. UC-2, Log-In, completed.

Exit conditions:

1. User has successfully updated account information.

Flow of events:

1. User selects the update personal information link from the home page.
2. The system displays all current fields stored in the database.
3. User updates one or more fields with new information.
4. System updates the database with new information.
5. System sends a verification of a successful account update.

Exceptions:

- *. The prospective user cancels the procedure at any time. All the new data are purged from the system and old data are restored.
 - 4a. System rejects application due to duplication found in user name.
 1. System directs the Prospective user to use a different user name for this account.
 - 5a. System fails to send a verification message.
 1. Repeat step 1 in flow of events.

Use case: UC-4 Choose Uniform for Own Rank

Primary Actors: Prospective User

Other Actor:

Stakeholders and Interest:

1. User wants to find a uniform authorized for own rank.

Entry conditions:

1. UC-1, Set Up Account, completed.
2. UC-2, Log-In, completed.
3. System has filtered available information based on the user's account information

Exit conditions:

1. System displays the desired uniform.

Flow of events:

1. User selects a particular type of uniform from the following list:
 - Evening Dress
 - Blue Dress
 - Service
 - Combat Utility
 - Specialty
2. System displays the sub-categories.
3. User selects a particular uniform from the sub-categories.
 - a. System displays photo of the selected uniform.
 - b. System displays text from Marine Corps Order (MCO).

Exceptions:

- *. System unable to display selected information. System shows error message.
 - 1a. User wants to change selection to a different type of uniform.
 1. Repeat step 1 from flow of events.
 - 3a. User wants to change selection to a different type of uniform.
 1. User selects "new uniform type" link.
 2. Repeat step 1 from flow of events.
 - 3b. User wants to change selection to a different uniform within the same type.
 1. Repeat step 3 from flow of events.

Use case: UC-5 Choose Uniform From Any Rank/Gender

Primary Actors: Prospective User

Other Actor:

Stakeholders and Interest:

1. User wants to gather information and photos on uniform regulations for ranks or genders other than his own.

Entry conditions:

1. UC-1, Set Up Account, completed.
2. UC-2, Log-In, completed.
3. System has filtered available information based on the user's account information

Exit conditions:

1. System displays uniform for any selected rank or gender.

Flow of events:

1. User changes the rank to the desired rank.
2. System filters available information to selected rank.
3. System disables personal awards feature that displays the user's awards.
4. User changes the gender to the desired gender.
5. System filters available information to selected gender.
6. User selects a particular type of uniform from the following list:
 - Evening Dress
 - Blue Dress
 - Service
 - Combat Utility
 - Specialty
7. System displays the sub-categories.
8. User selects a particular uniform from the sub-categories.
 - a. System displays photo of the selected uniform.
 - b. System displays text describing the uniform in accordance with Marine Corps Order (MCO).

Exceptions:

- *. System unable to display selected information. System shows error message.
 - 1a. User desires to change to any rank at any time.
 1. Repeat step 1 from flow of events.
 - 4a. User desires to change gender at any time.
 1. Repeat step 4 from flow of events.
 - 6a. User wants to change selection to a different type of uniform.
 1. Repeat step 6 from flow of events.
 - 8a. User wants to change selection to a different type of uniform.
 1. User selects "new uniform type" link.
 2. Repeat step 6 from flow of events.
 - 8b. User wants to change selection to a different uniform within the same type.

Repeat step 8 from flow of events:

Use case: UC-6 Display Measurements for Uniform Items
Primary Actors: Prospective User
Other Actor:

Stakeholders and Interest:

1. User desires measurement specifications for any part of the uniform such as trouser length, belt length, blouse arm length etc.

Entry conditions:

1. UC-4, Choose Uniform for Own Rank or UC-5, Choose Uniform From Any Rank/Gender completed.

Exit conditions:

1. System displays desired measurements on photo and also displays the corresponding text from the MCO.

Flow of events:

1. User mouses over hotspots that dissect the photo of the desired uniform.
2. System magnifies the area as it is moused over.
3. User selects desired area.
4. System displays a short description on the photo.
5. System displays the detailed verbiage associated with the selected area in accordance with MCO.

Exceptions:

- *. System unable to display selected information. System shows error message.
- 3a. User desires to select a different area.
 1. Repeat step 3.

Use case: UC-7 Display Grooming Standards
Primary Actors: Prospective User
Other Actor:

Stakeholders and Interest:

1. User desires the USMC grooming standards. The grooming standards can be accessed by a link from the main menu or from any photo of a desired uniform.

Entry conditions:

1. UC-2, Log-In, completed.

Exit conditions:

1. System displays desired grooming standards on photo and also displays the corresponding text from the MCO.

Flow of events:

1. User desires information regarding grooming standards.
 - a. User selects grooming standards link from the main menu.
 - a. System displays a large view of the head area with hotspots that dissect the area further.
 - b. User mouses over hotspots of the head area on the displayed photo as in UC-6.
 1. System magnifies the area as it is moused over.
 2. User selects desired area.
 3. System displays a large view of the head area with hotspots that dissect the area further.
2. User selects the specific area desired.
3. System displays a short description on the photo.
4. System displays the detailed verbiage associated with the selected area in accordance with MCO.

Exceptions:

- *. System unable to display selected information. System shows error message.
- 1a. User selects a different link from the main menu.
 - 2a. User desires a different area.
 1. Repeat step 2 in flow of events.

Use case: UC-8 Display Awards Precedence
Primary Actors: Prospective User
Other Actor: Database

Stakeholders and Interest:

1. User desires to see the display in order of precedence of own awards or entered awards. The awards can be accessed from the main menu or from linking to the hotspot found on the main photo as in UC-6, Display Measurements for Uniform Items.

Entry conditions:

1. UC-1, Set Up Account, completed.
2. UC-2, Log-In, completed.
3. If the awards are to be accessed from the displayed photo vice the main menu, UC-6, Display Measurements for Uniform Items, must be completed.

Exit conditions:

1. System displays the photos of the desired awards in the correct order of precedence in accordance with the MCO.

Flow of events:

1. User desires to view awards precedence or measurements of awards and insignias as stored under his user name.
 - a. User selects awards from the main menu or user selects the awards hotspot found on the displayed photo as in UC-6, Display Measurements for Uniform Items.
 - b. System accesses the data base and retrieves the previously stored information as created in UC-1, Set Up Account.
2. User desires to view awards precedence or measurements of any awards.
 - a. User selects the input awards link.
 - b. User inputs the desired awards and insignias.
3. The system retrieves all images to corresponding awards and arranges them in order of precedence in accordance with MCO.
4. The system displays the images along with the correct measurements of awards and insignias in accordance with MCO.

Exceptions:

- *. System unable to display selected information. System shows error message.
- 1a. User desires to update existing awards data base.
 1. User selects update awards link.

2. User changes account information as in UC-3, Update Account Information.
3. Repeat step 1 in flow if events.

K. SEQUENCE DIAGRAMS

Set Up Account:

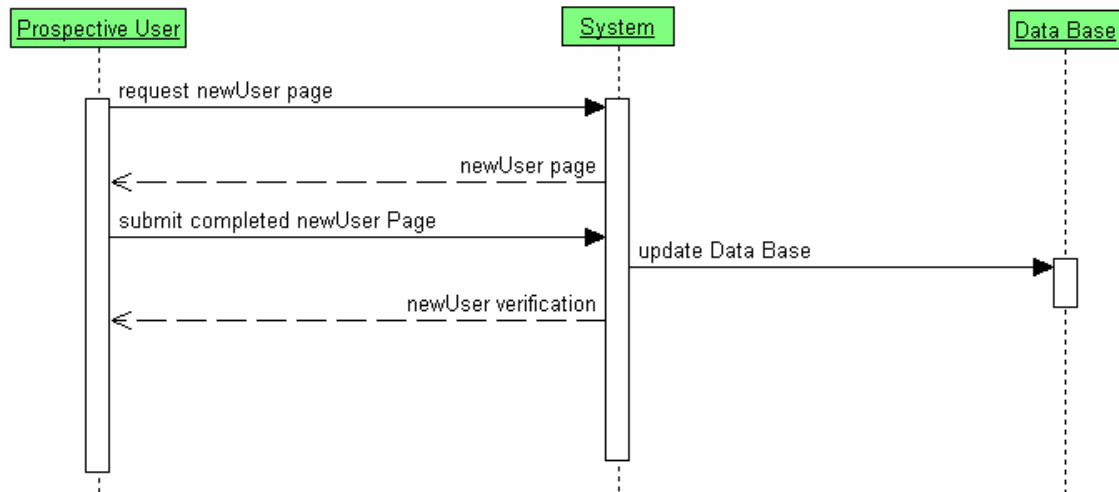


Figure 6. Set Up Account

Log-In:

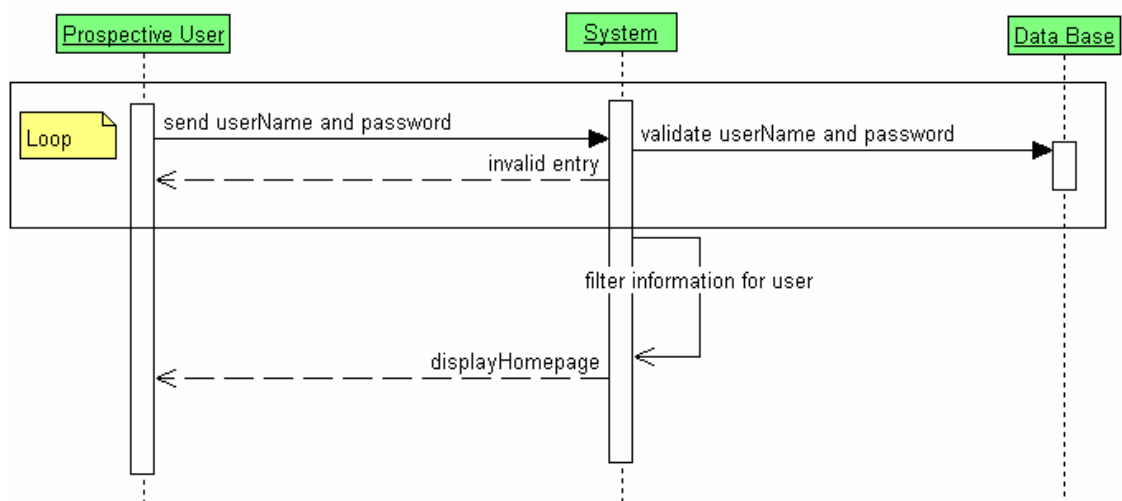


Figure 7. Log-In

Update Account Information:

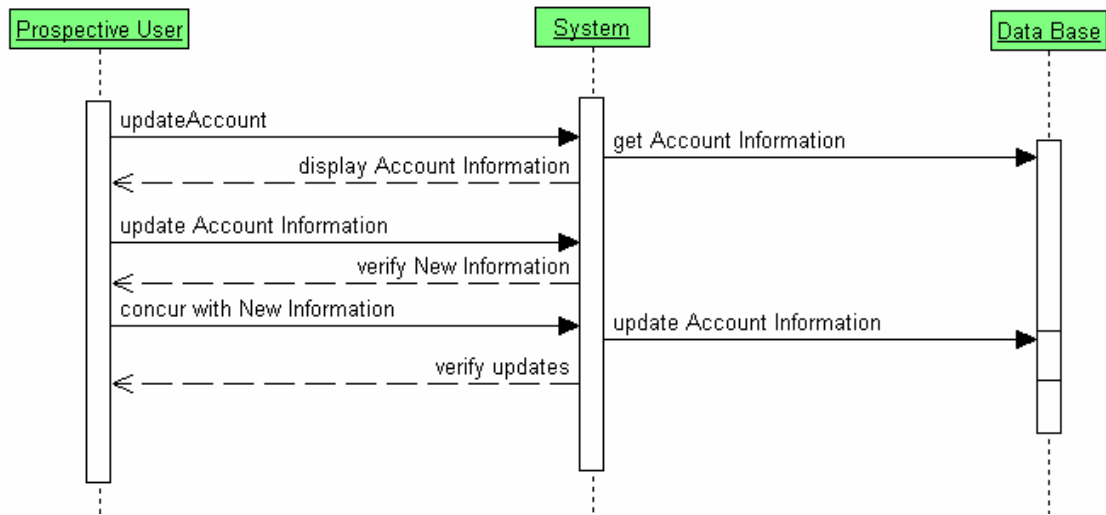


Figure 8. Update Account Information

Choose Uniform for Own Rank:

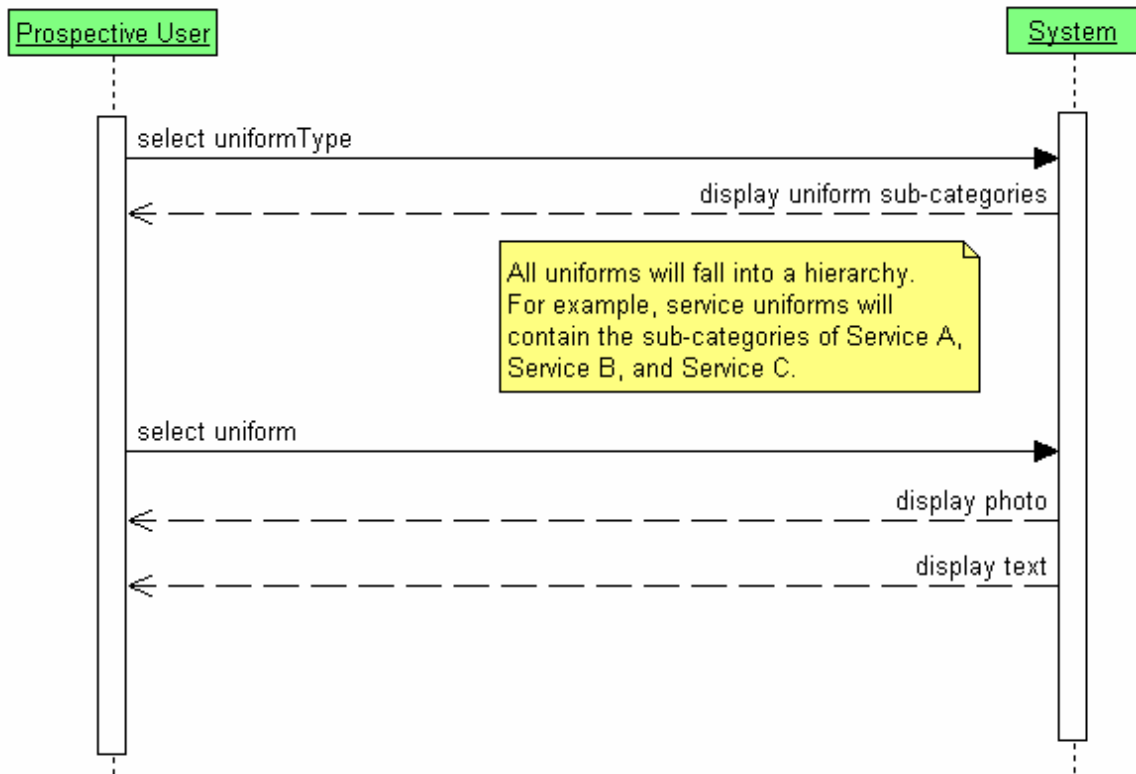


Figure 9. Choose Uniform for Own Rank

Choose Uniform From Any Rank/Gender:

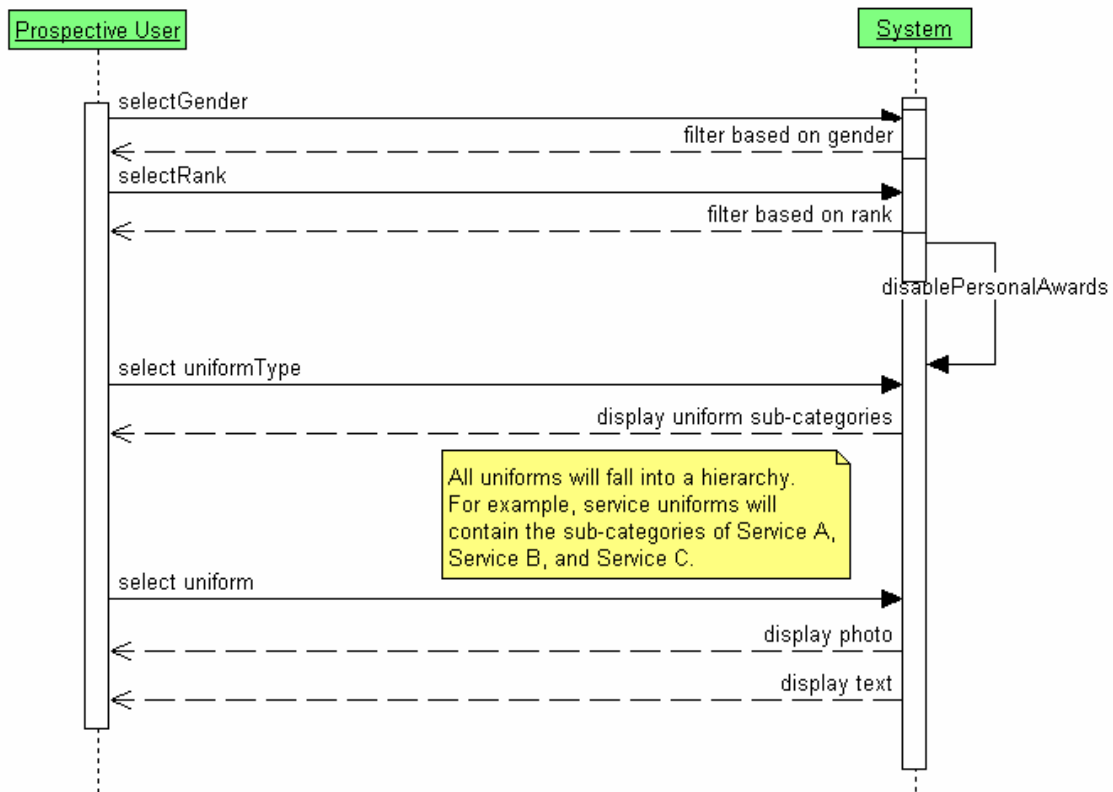


Figure 10. Choose Uniform From Any Rank/Gender

Display Measurements for Uniform Items:

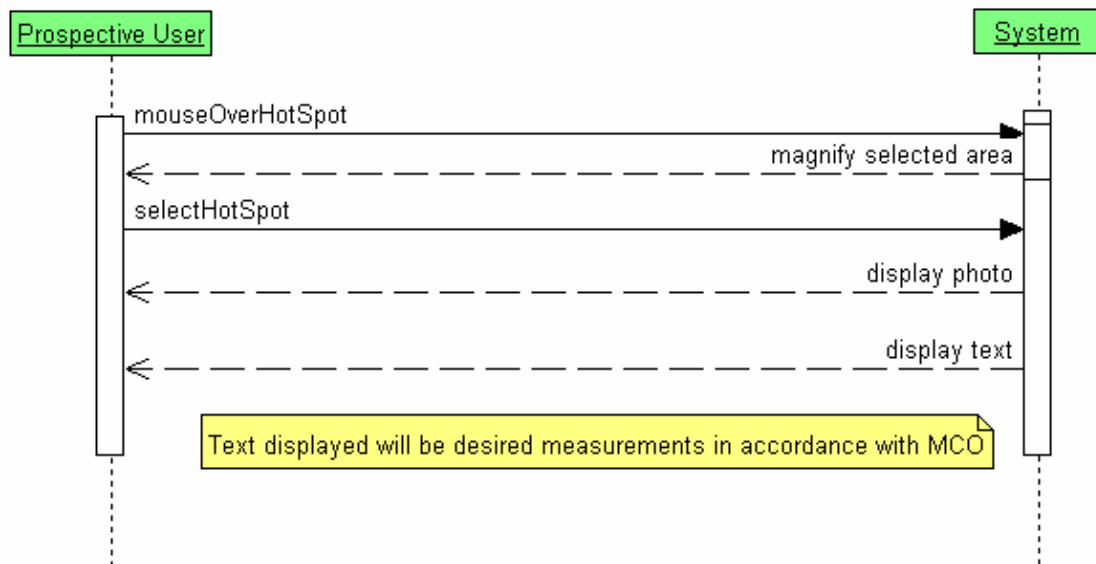


Figure 11. Display Measurements for Uniform Items

Display Grooming Standards:

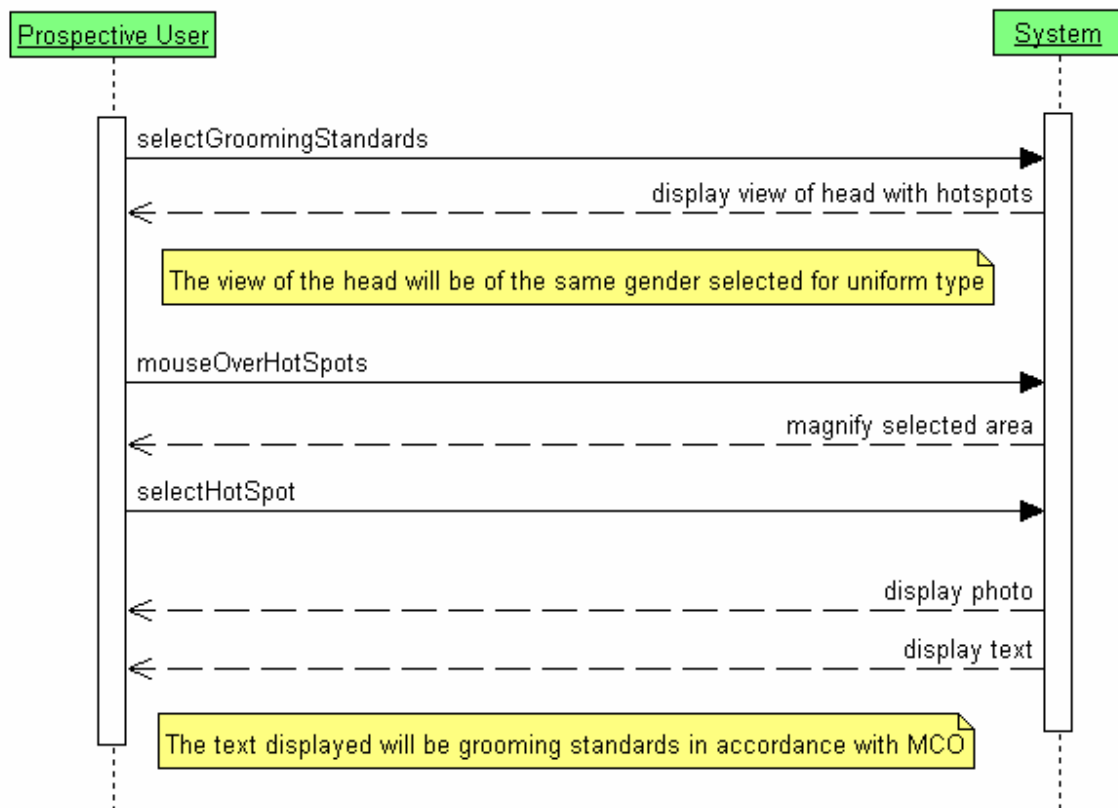


Figure 12. Display Grooming Standards

Display Awards Precedence:

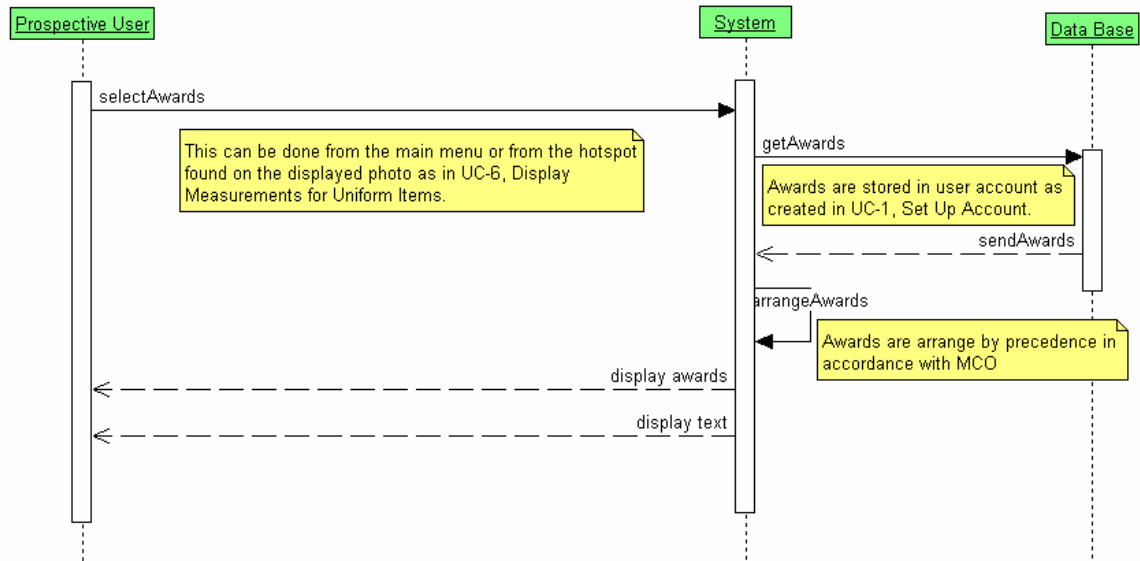


Figure 13. Display Awards Precedence

L. FLOW CHARTS

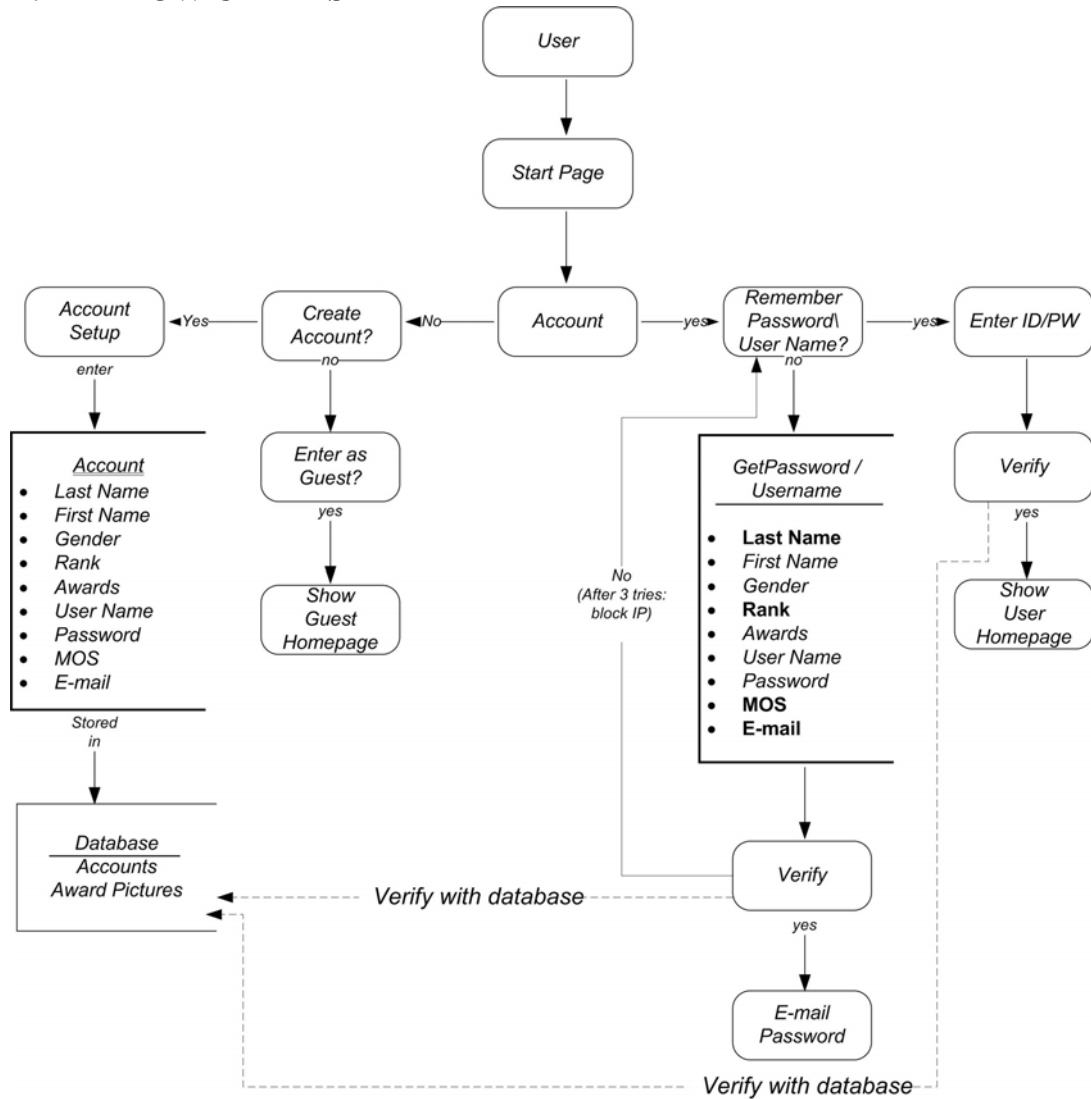


Figure 14. Flow Chart 1

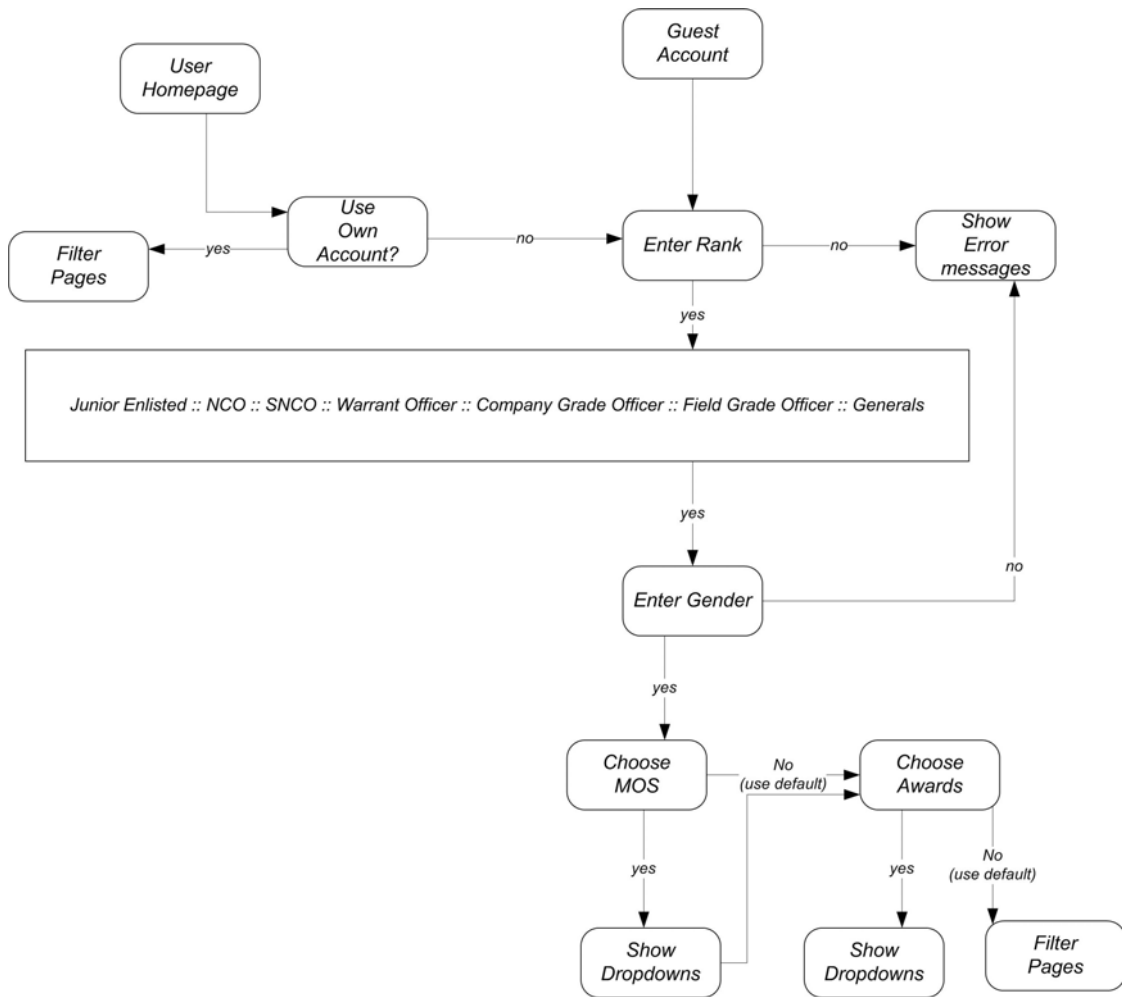


Figure 15. Flow Chart 2

M. HOME PAGE INFORMATION

1. Home Page Selections

Uniforms

Grooming Standards

Awards

Civilian Clothes

PT Gear

Musical Units

Organizational Clothing

2. Home Page Flow Charts

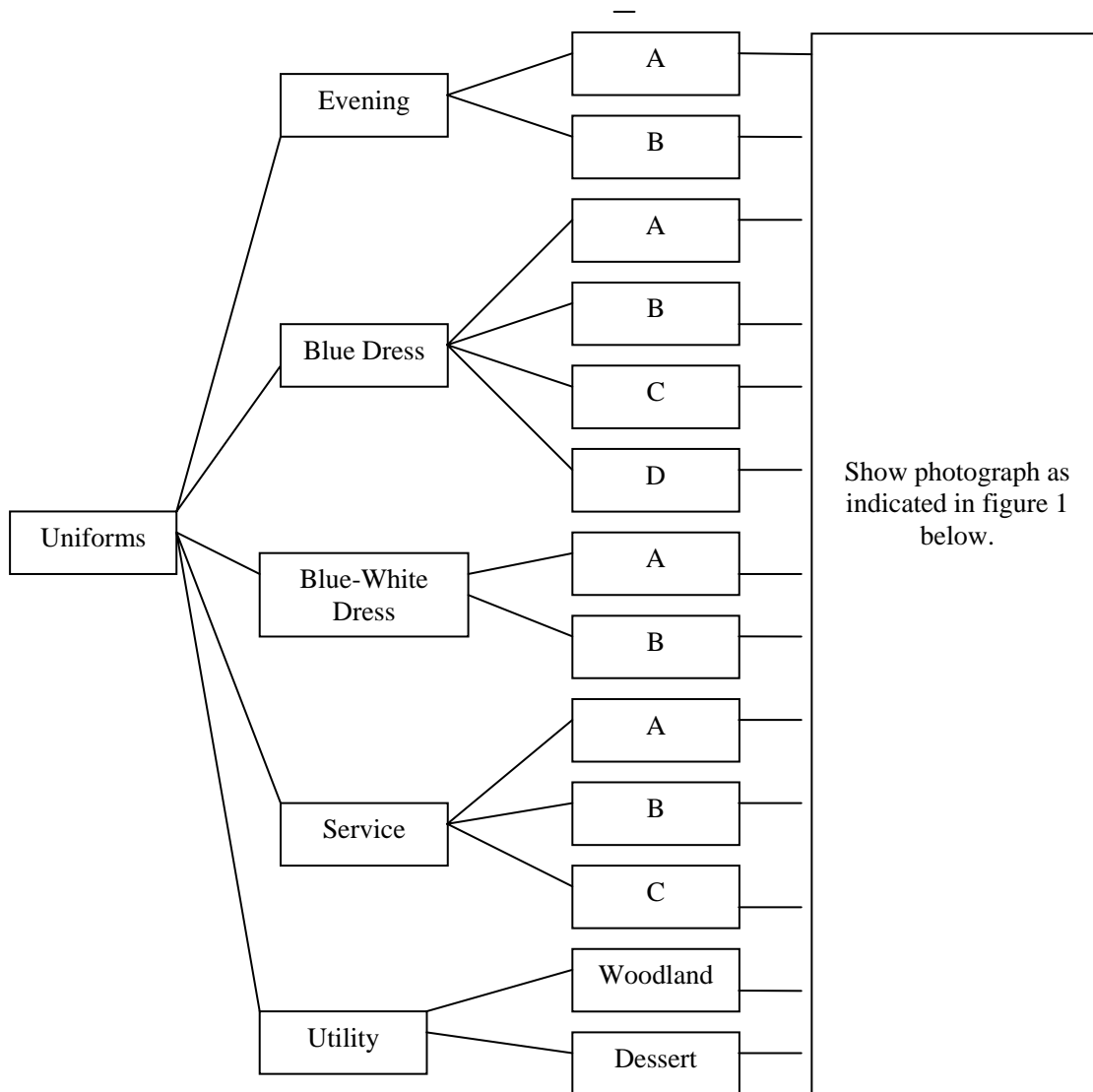


Figure 16. Home Page Flow Chart

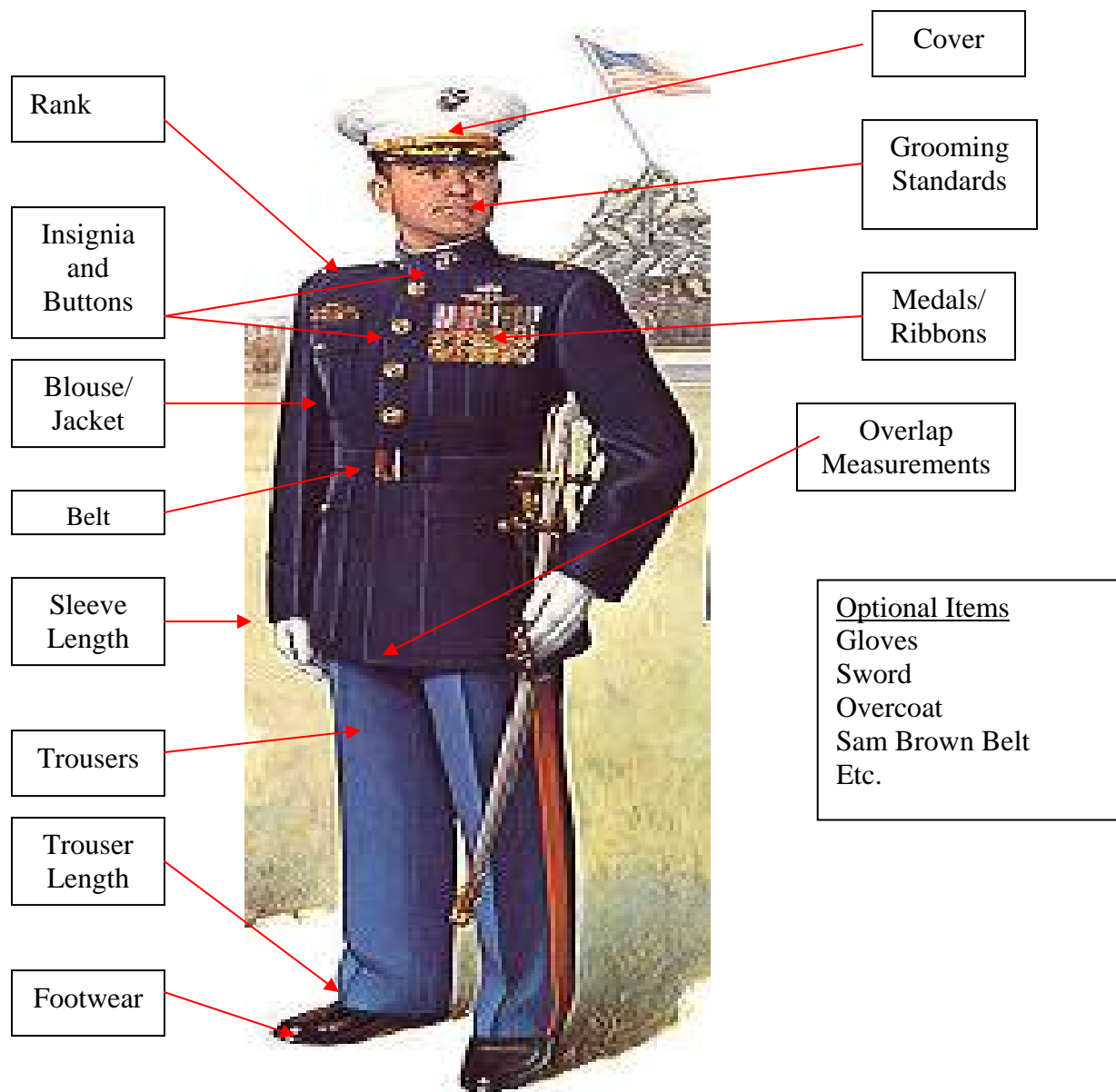


Figure 17. Typical Sections for a Photograph

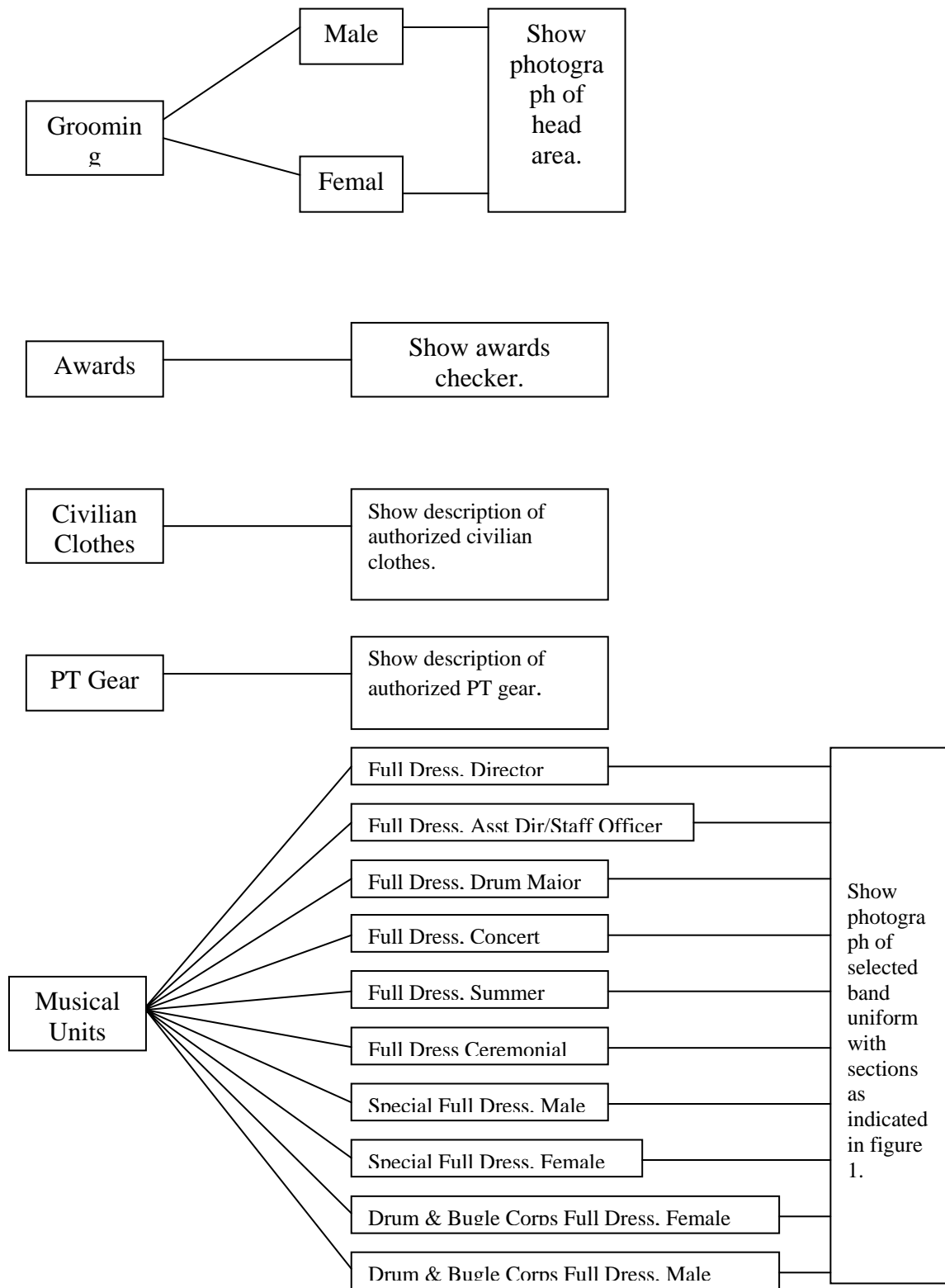


Figure 18. Main Menu

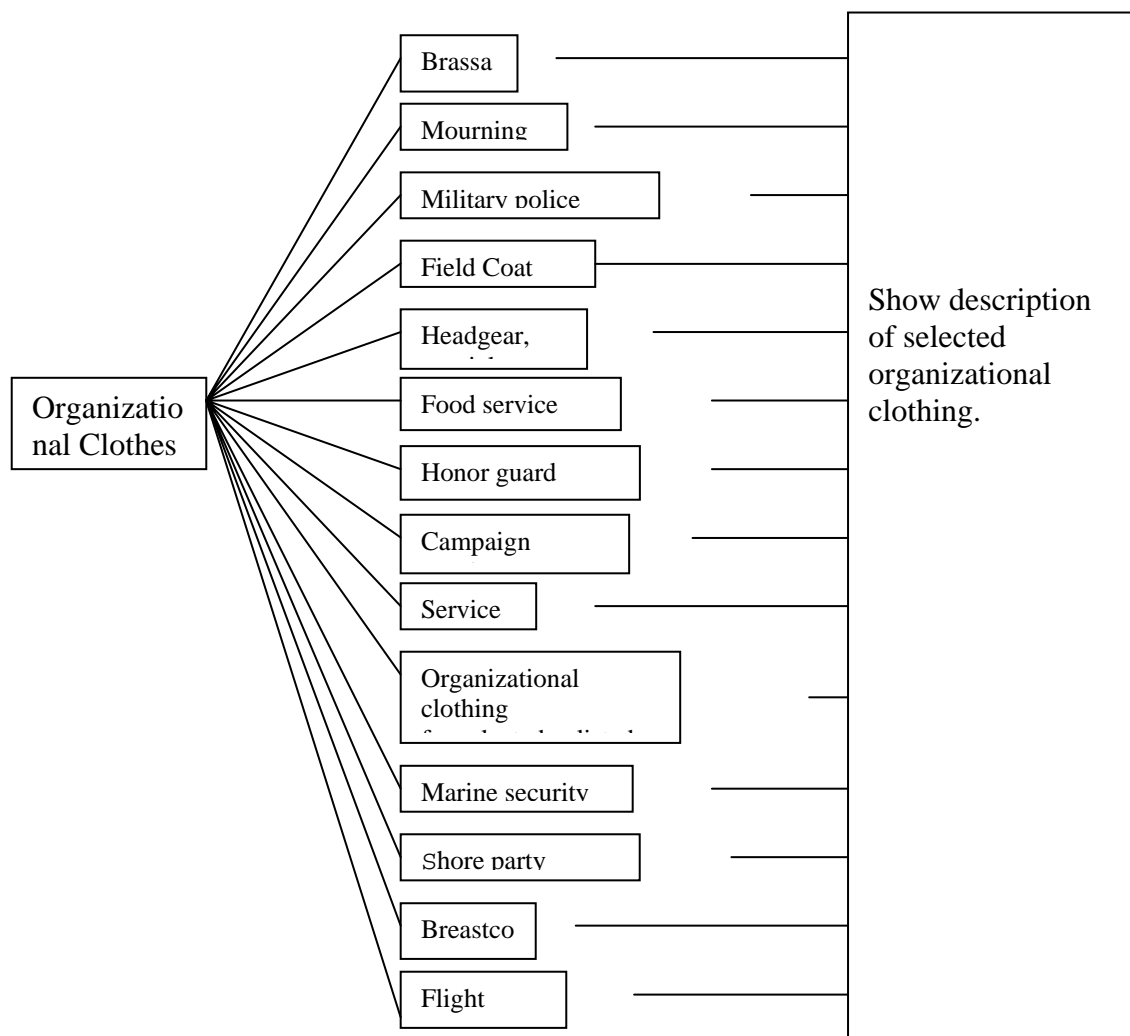


Figure 19. Organizational Menu

II. SOFTWARE DESIGN SPECIFICATIONS (SDS)

A. REVISION SHEET

[illegible]

B. INTRODUCTION

1. Purpose

The purpose of the Software Design Specification (SDS) is to describe the functionality of the Web Based Uniform Manual. The SDS will be presented to the customer for review, comment, and validation of the design. This document describes the subsystems and modules that form the Graphical User Interface, server requirements, and Database requirements. The SDS provides highly detailed technical data, system information, and other relevant information on the Web Based Uniform Manual. This document includes an architecture diagram, a design class diagram, interaction diagrams, state diagrams, and a glossary.

2. Scope and Audience

The web based manual described in this document will be in strict accordance with MCO P1020.34G. This system will be relied on by Marines world wide as an accurate source of standards that ensure their compliance with the MCO. The new design will be IAW the principles of HCI and will support quick links and menu driven systems that will allow all relevant information to be displayed or hidden as the user requires. The new system will address all aspects currently outlined in the regulations, such as proper wearing of the uniform, grooming standards, ribbon and medal precedence, civilian attire, PT gear, and optional items for male and female officers and enlisted U. S. Marines. This system could be used by all US civilians and military service members to whom the current manual is now relevant.

3. Goal Statement

The overall goal of the project will be to create an easy to use GUI based uniform regulation guide. This system will be web based and will be designed to accommodate further maintenance and reuse.

4. Implementation & Special Features

The guide will be implemented using primarily visual aides and follow the practices of good Macro/Micro HCI Design. The aim will be to provide the needed information to the user in an easy to use GUI interface that requires minimal “mouse clicks” to retrieve the desired information. The guide will also provide the user with alternative text from the Marine Corps Order P1020.34G dealing with the specific uniform in question. The end result will be an easy to use research tool that may be utilized by members of the United States Marine Corps to ensure that their uniform is within regulations.

5. System Use

The use of the system will support quick links and menu driven systems that will allow all relevant information to be displayed or hidden as the user requires. The new system will address all aspects currently outlined in the regulations and described in the Requirements Analysis Document referenced. This system will be used by all US civilians and military service members to whom the current manual is now relevant.

6. REFERENCES

- Bruegge, Bernd. *Object-Oriented Software Engineering*. Pearson Prentice Hall, Inc. 2004
- Larman, Craig. *Applying UML and Patterns: an introduction to object oriented analysis and design and iterative development*. Pearson Education Inc. 2005.
- Braude, Eric. *Software Design: From Programming to Architecture*. Wiley, Inc. 2004.
- M. Villar, C. Krause. *Web Based Uniform Regulations Manual Requirements Analysis Document*. Naval Postgraduate School. Monterey, CA. January 2006.

C. HCI DESIGN AND JUDGMENT CATEGORIES

1. Simplicity

Simplicity provides the means by which the web page aims to keep the basic utility of the interface easy to use, and offer facilities which are of a clear value to the military member. The interface should be intuitive and there should be no question as to how to use this manual.

2. Consistency

The user should feel that he or she is in control and that the system is responding to his or her actions accordingly. Users should have control over the amount of information they receive at different points of the interaction. During the interaction, the web page should have a common look and presentation that is presentable and professional. As shown in Figure 16, this manual will be broken up into four main categories; male officer, male enlisted, female officer, female enlisted. During exploration of this manual, each category will be easily identified. This will allow for ease of presence within this site.

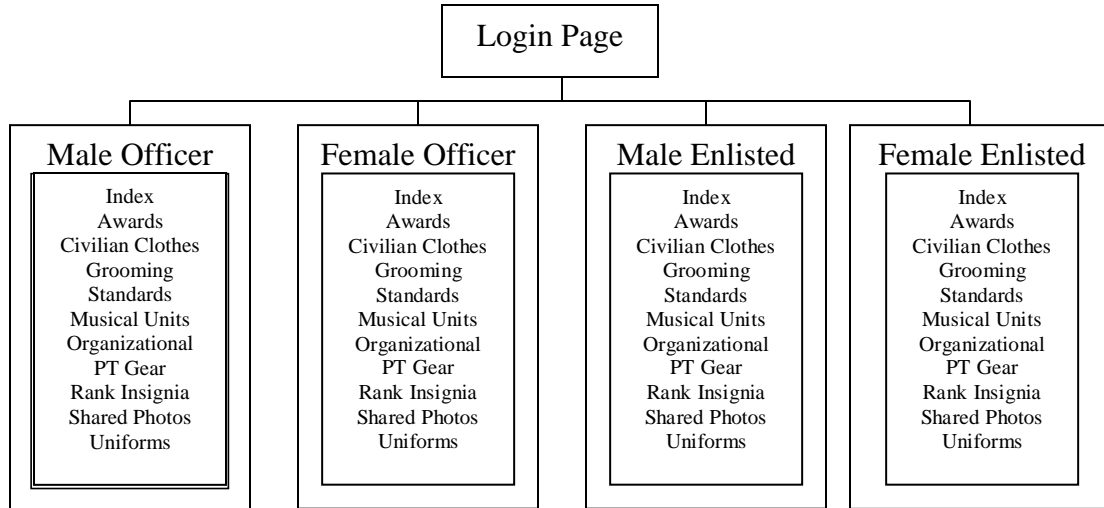


Figure 20. Four Main Categories

3. Control

Control actions initiated by the user should receive the appropriate responses. Error and control messages should generate the same responses throughout this site.

4. Shortcuts and Customization

The web page should present mechanisms for users to customize settings to speed frequency of use by users.

5. Screen layout

The screen layout should give an appearance of clarity with the proper use of white space to separate items. Items should be presented in a balanced fashion, and not distort during screen resolution change. Additionally, control maneuvers should be reachable without scrolling extensively.

6. Feedback

Appropriate feedback before, during, and after interaction is essential to proper HCI. Prompts and directions should be provided to the user at all times. The user should never be left in a state of question.

7. Error Handling

There shall be no means of deleting or changing information. This action will allow the user freedom of experimentation without degradation of the information presented on this site. This will ensure error handling is at a minimum in regards to development of this site.

8. Efficiency

All accessible elements of the web page are generated in a timely manner. The information provided within this site will be in conjunction with the latest regulation regarding the specific uniform in question. In an effort to speed efficiency, a “SEARCH” feature should also be implemented. The added feature will allow expert users extended usability of this manual.

9. Help Facilities

The web page will provide a mechanism to report problems or errors. Additional help facilities regarding military uniform regulations will also be provided.

10. Navigation

Navigation within the web presence should be easily achieved with minimal “clicks” or drop down menus to achieve a desired result.

11. Objects

Each major category will have similar index pages and file structures. The objects that will be created from the index page as the user completes a search for desired information are shown in Figure 17. Generic layouts for other pages are shown in Figures 18 and 19. These are not objects as normally recognized in object oriented programming, but we refer to them as objects for explanatory purposes. Since this entire system is web based, objects are not truly created but rather each selection calls a desired page within the web server.

Navigation Bar Home Uniforms Grooming Awards Rank Insignia Civilian Clothes PT Gear Organizational Musical Units	
Member Info Male/Female Rank	Main Photo Area
Contact Info Help Manual	
Links	Detailed Text from Marine Corps Order P1020.34G MCO

Figure 21. Index Page Layout

Navigation Bar Home Evening Blue Dress Blue/White Dress Service Utility	
Links	Main Photo Area
	Detailed Text from Marine Corps Order P1020.34G MCO

Figure 22. Typical Uniform Page Layout

Navigation Bar Home Evening Blue Dress Blue/White Dress Service Utility		
Optional Items	Main Photo Area	Detailed Sections
Detailed Text from Marine Corps Order P1020.34G MCO		

Figure 23. Typical Uniform Type Page Layout

D. MAINTAINABILITY

This system must be designed in order to allow for easy maintenance. The designers of this system will not be responsible for any future maintenance of this system. It is our intention to build this site and turn all files over to Headquarters Marine Corps for implementation. Our design goal is to allow this site to be usable for many years to come within the Marie Corps. This can only be achieved if the site is easily maintainable and files can be edited or deleted as the MCO changes. In order to achieve the desired maintainability, the design must adhere to the following:

1. Reliability

The reliability of this system will be dependent on the stability of the code and the capacity for system upgrades. The design of this system will be done with the goal of system reliability in mind.

2. Efficiency

This system must be designed to maximize the efficiency of the code. This will be done by inhibiting overloading and preventing unnecessary parts of the code. All written code will be thoroughly scrubbed for gratuitous code or files.

3. Understandability

This will be a key aspect to maintaining this site. The documentation provided here as well as the structure of the files will help future maintainers to understand the site and assist in implementing any changes. It is unknown as to the technical expertise and experience of the future maintainer of this site so full documentation is critical.

4. Measurability

Software metrics can be used to estimate the project budget and schedule, evaluate individual productivity and quality, evaluate project productivity and quality, and evaluate the system quality.

E. REUSE

The design specifications for this system call for the design of a web based uniform manual for the United States Marine Corps. However, the same need can be paralleled to any service within the Department of Defense or any international military organization. This system will be designed with the concept of reuse in mind. The system developed here can be easily transferred into any other service branch. This will be done with a file structure that is generic enough to allow for the input of any uniform type and a system structure that can support any similar specification.

F. SECURITY

The information on this site needs to be in complete compliance with Marine Corps Order P1020.34G. Any deviations from this standard render this site useless. The threat of hackers is always present when dealing with the web based systems. If any user can break through and change any of the information on our website, it will sacrifice the integrity of the information posted. Once the information is found to be inaccurate, it will render our system unreliable and discourage its use.

G. SYSTEM ARCHITECTURE

The Web Based Uniform Regulations Manual is organized into a three-tier closed architecture composed of a presentation layer, application logic layer (domain), and storage/network layer (services). The purpose of this organization is to promote reuse, support distributed processing, and allow parallel team development. Also, by building

each layer only in terms of each immediate lower layer, this design will reduce dependencies between each layer enabling the system to be combined with other hardware/software platforms with minimal rewriting of single layers.

The System Architecture decomposes the Web Based Uniform Regulations Manual system into subsystems by vertical layers and horizontal partitions. The presentation, domain, and service top layers are represented by the common graphical user interface (GUI), CTF Infrastructure, and Computer Website services subsystems respectively. Figure 20 illustrates the organization of subsystem layers and partitions within the Web Based Uniform Regulations Manual System Architecture.

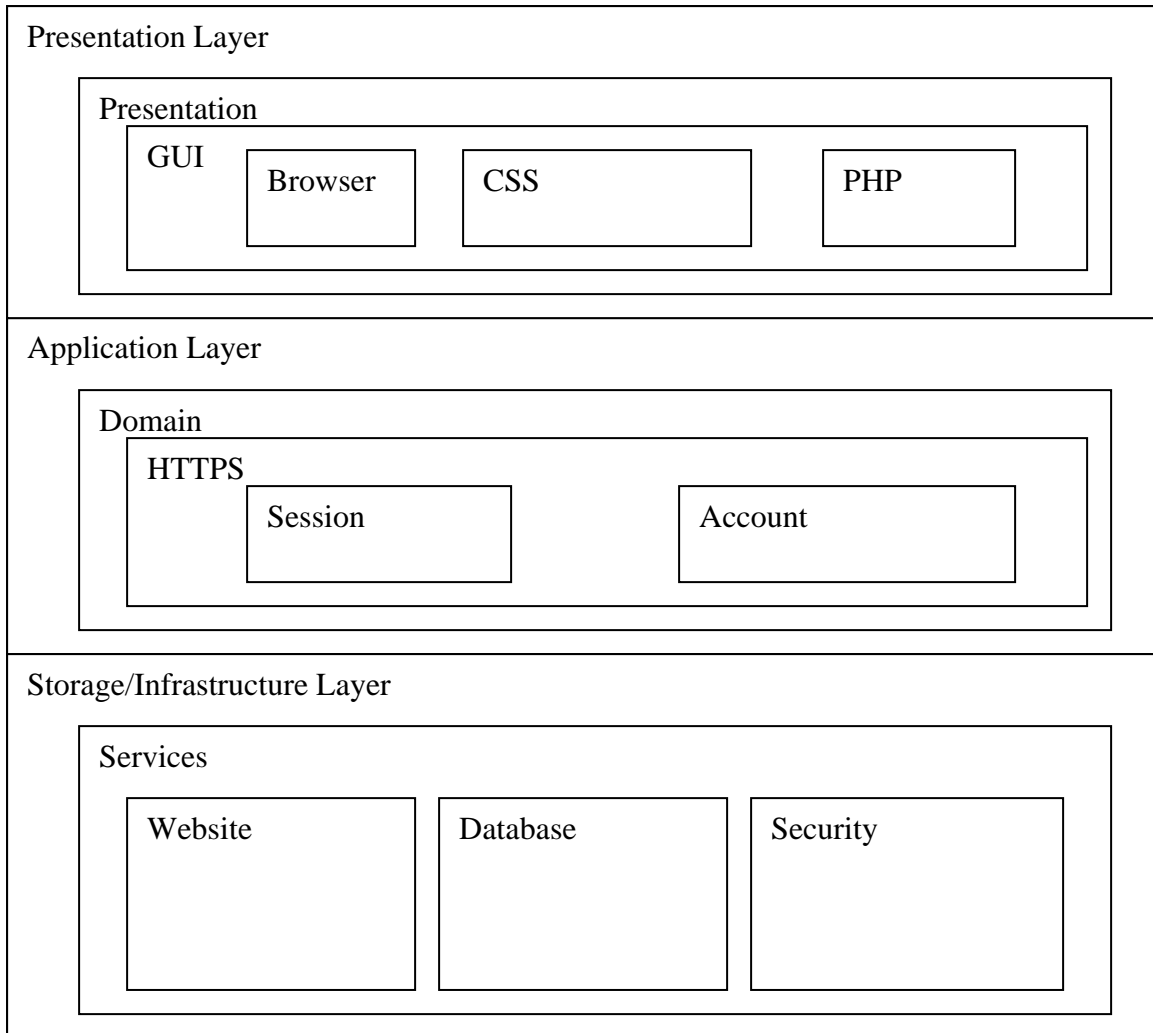


Figure 24. System Architecture Diagram

H. PRESENTATION LAYER

A web browser will function as the client interface. Its sole purpose is the display of the Web server generated HTML pages. To create a platform independent experience the page layout will be controlled by Cascading Style Sheets. These style sheets, once cached by the browser, will also account for faster webpage loading. All content creation will be done by server side PHP scripting, again contributing to a browser independent display without the need for client side browser plugins (like Java script), thus speeding up the page load time and avoiding safety critical scripting on the client computer. This will also allow handheld devices, which are not always equipped with scripting capable browser, to load and display the interface pages.

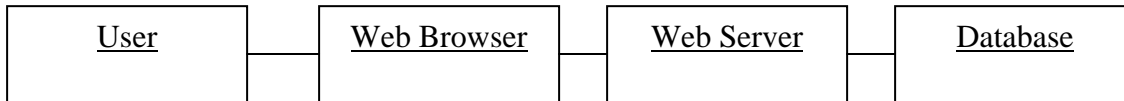


Figure 25. Context Diagram

I. APPLICATION LAYER

The middle tier is divided in two units with different functions. An intermediate layer (web server) implemented in a scripting language (PHP). This layer receives requests from the Internet clients and generates html using the services provided by the storage/Infrastructure layer. This additional layer provides isolation between the application layout and the application logic.

This system will be designed to reside on an Apache Web Server. The Apache Web Server has several advantages. It is extremely powerful, modular, flexible, highly configurable, and extensible. It is freely available through open source which means that its source code is examined constantly by numerous users. This constant examination by outsiders, makes it substantially more reliable than any commercial software product that can only rely on the scrutiny of a closed list of employees. Apache currently runs on approx. 68-70% of all web servers worldwide making it the #1 choice of web servers since 1996. This makes it the most secure web server worldwide.

J. STORAGE/INFRASTRUCTURE LAYER

The basic design philosophy that we will follow is to create four complete and separate sites that can actually completely stand alone and have a common link from the login page as shown in Figure 22.

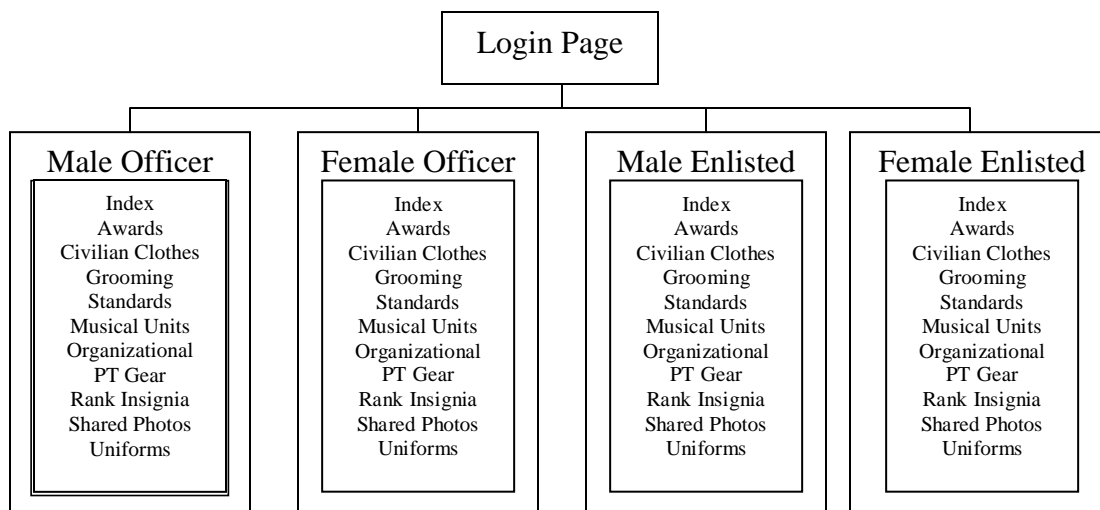


Figure 26. Site Layout

This type of architecture will allow us to extensively test while developing the site. We can first create the Male Officer “site” in its entirety and test this module. Then we can create the login page and develop its functionality. Once the login page is linked to the Male Officer “site”, we can exhaustively test this smaller system and develop it completely. Then it would simply be a duplication of the Male Officer “site” in order to create the Female Officer “site”, the Male Enlisted “site”, and the Female Enlisted “site” (allowing for the subtle nuances of each subcategory). The final step in architecture design will be to link all four subcategories to each index page. For example, if a user is currently in the Male Officer “site” and he desires to look at female enlisted uniforms, he can quickly access the index page of the Female Enlisted “site” and now navigate through that “site”.

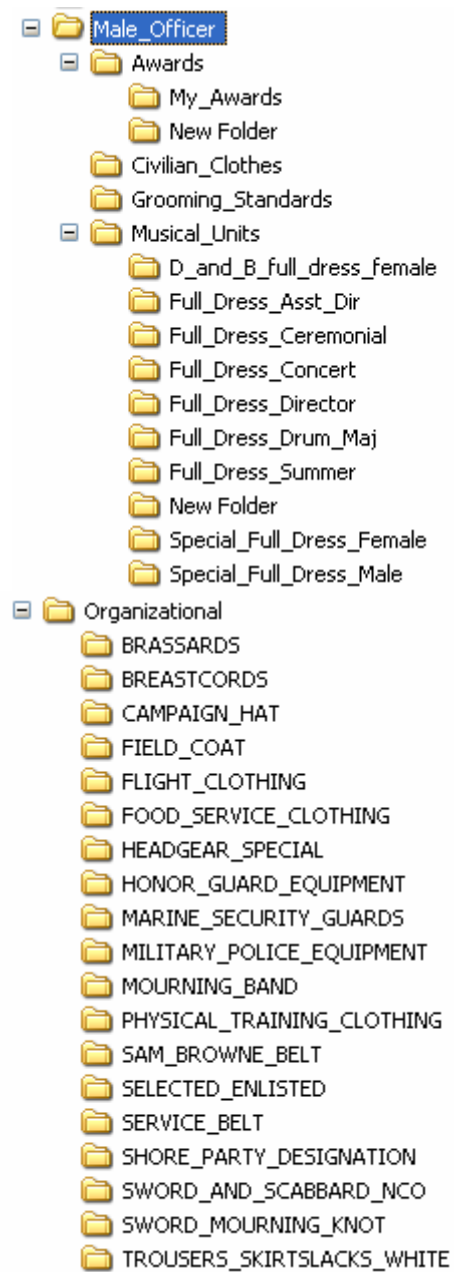
1. File Naming

All four subcategories will share the same file names as shown in figure 23. This will allow for the quick creation of the remaining subcategories after the first one is created. This type of file naming pattern lends is attainable since all ranks and genders within the USMC must follow the same manual. Also all ranks and genders within the USMC have the same uniform names but the style of the uniform varies between ranks and gender. A clear and concise file structure is imperative for construction of this site

and to ensure maintainability. All files need to be arranged in a manner that is easy to follow and is unambiguous since this system will not be maintained by the original design team.

2. File Layout

All files will be placed in one of four substructures that are referenced from a main index page. As mentioned earlier in this document, the files will be broken up into four main categories; male officer, male enlisted, female officer, female enlisted. Figure 23 shows the file structure for male officers. This structure will be repeated for all other categories.



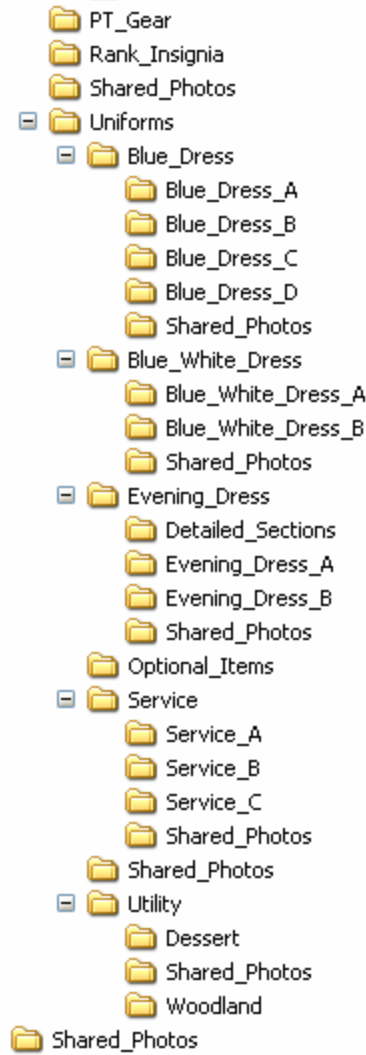


Figure 27. File Structure

3. Database

The Relational Database MySQL provides the persistent storage for user specific data. It will communicate with the presentation layer via the PHP scripting language.

4. Security

Apache provides security-related configuration directives enabling administrators to tighten the security:

- User / Group: Defines user/group Apache should run as
- LimitRequestBody: Restrict total size of HTTP request body sent from a client
- LimitRequestFields: Limit number of HTTP request header fields that will be accepted from the client
- LimitRequestFieldSize: Limit size of the HTTP request header allowed from the client
- LimitRequestLine: Limits overall size of the HTTP request line that will be accepted
- Listen: Defines the IP addresses and ports the server listens on
- ServerTokens: Server HTTP response header
- ServerSignature: Content of footer available on server-generated documents
- SSLEngine: Toggle usage of SSL/TLS protocol engine
- UserDir: Indicates the location of user-specific directories

K. CLASS MODEL

Figure 24 of this document shows the system's SCRS Class Diagram. It illustrates the basic context in which the whole SCRS system operates.

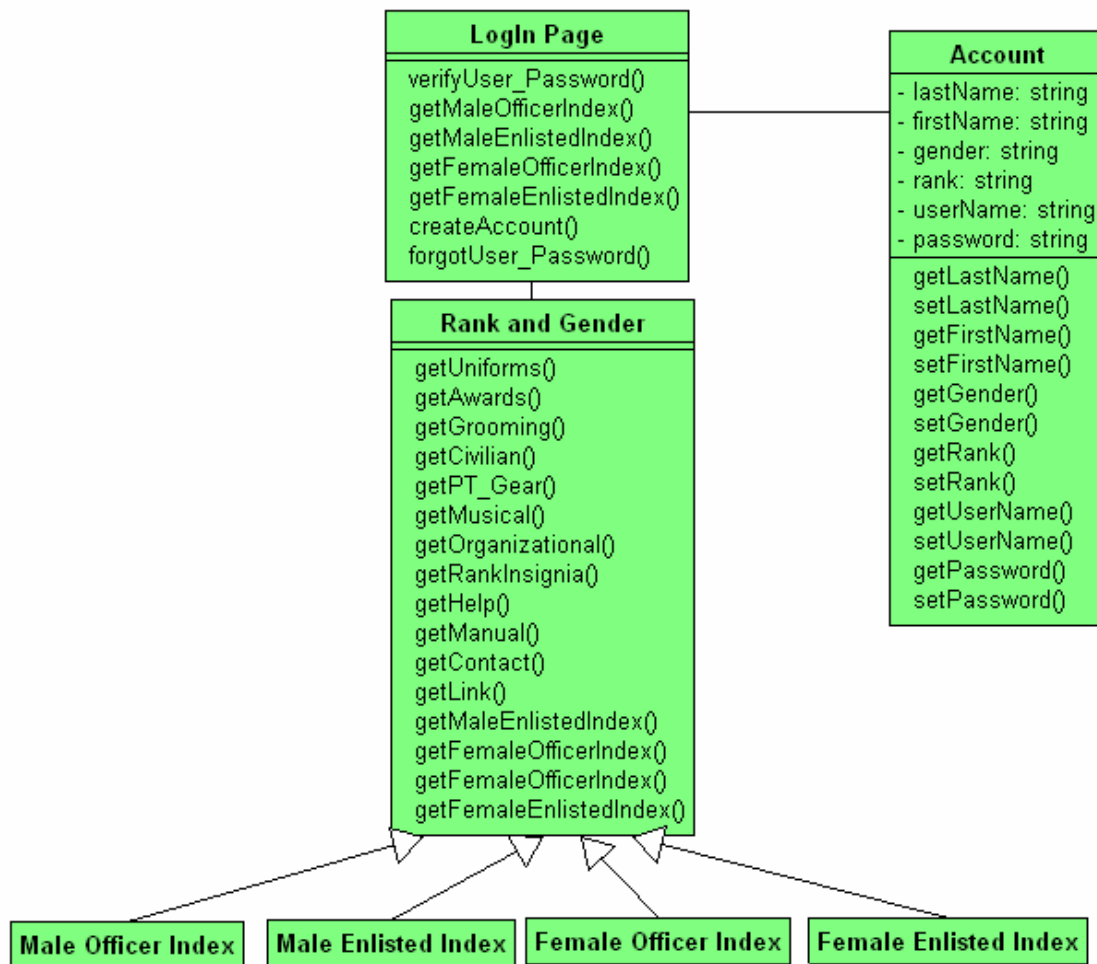


Figure 28. Class Diagram

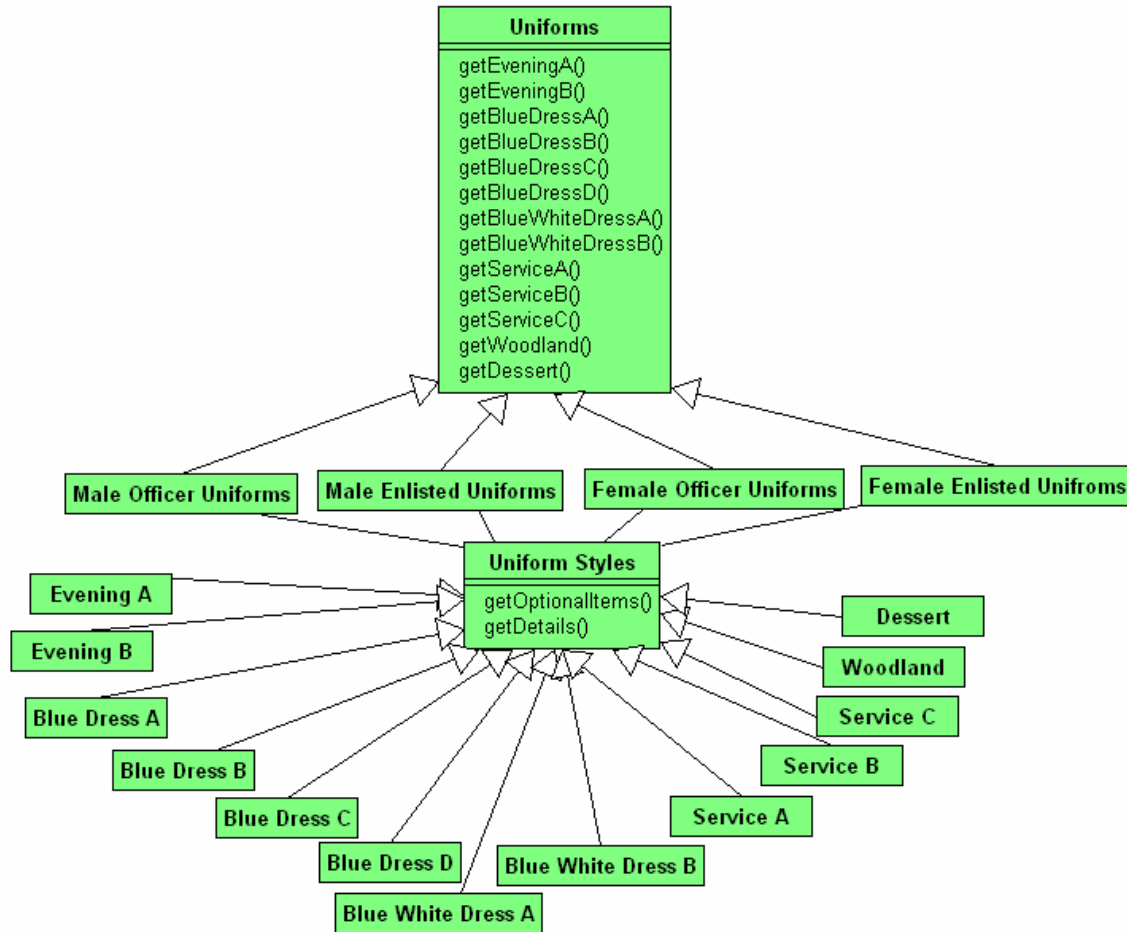


Figure 29. Class Diagram

L. LOGIN PAGE

1. `verifyUser_Password()`

A password is provided by the user and passed by the web browser to the system.

2. `getMaleOfficerIndex()`

Used to get the index page of the Male Officer Subcategory.

3. `getMaleEnlistedIndex()`

Used to get the index page of the Male Enlisted Subcategory.

4. `getFemaleOfficerIndex()`

Used to get the index page of the Female Officer Subcategory.

5. `getFemaleEnlistedIndex()`

Used to get the index page of the Female Enlisted Subcategory.

6. `createAccount()`

The user desires to create a new account which is passed to the system by the web browser.

7. `forgotUser_Password()`

The user needs a reminder of his password which is passed to the system by the web browser.

M. ACCOUNT

1. lastName:String

Used for the last name of the user account.

2. firstName:String

Used for the first name of the user account.

3. gender:String

Used for the gender of the user account.

4. rank:String

Used for the rank of the user account.

5. username:String

Used for the user name of the user account.

6. password:String

Used for the password of the user account.

7. getLast_name()

Once the account is set up, this method will be used to retrieve the user's last name from the database.

8. setLast_name()

This method will be used to set up an account in the database with the user's last name.

9. getFirst_name()

Once the account is set up, this method will be used to retrieve the user's first name from the database.

10. setFirst_name()

This method will be used to set up an account in the database with the user's first name.

11. getGender()

Once the account is set up, this method will be used to retrieve the user's gender from the database.

12. setGender()

This method will be used to set up an account in the database with the user's gender.

13. getRank()

Once the account is set up, this method will be used to retrieve the user's rank from the database.

14. setRank()

This method will be used to set up an account in the database with the user's rank.

15. getUsername()

Once the account is set up, this method will be used to retrieve the user's user name from the database.

16. setUsername()

This method will be used to set up an account in the database with the user's user name.

17. getPassword()

Once the account is set up, this method will be used to retrieve the password from the database.

18. setPassword()

This method will be used to set up an account in the database with the user's password.

N. RANK AND GENDER

1. getUniforms()

This method will be used to get the Uniforms HTML page.

2. getAwards()

This method will be used to get the Awards HTML page.

3. getGrooming()

This method will be used to get the Grooming Standards HTML page.

4. getCivilian()

This method will be used to get the Civilian ClothesHTML page.

5. getPT_Gear()

This method will be used to get the PT Gear HTML page.

6. getMusical()

This method will be used to get the Musical Organizations HTML page.

7. getOrganizational()

This method will be used to get the Organizational HTML page.

8. getRankInsignia()

This method will be used to get the Rank Insignia HTML page.

9. getHelp()

This will be a function that allows the user to request guidance on any object or function that may be unclear.

10. getManual()

This will list the current versions of the uniform regulations manuals used for this web site.

11. getContact()

This will display the contact information of the web designer and manager. This will also contain contact information for Marine Corps' uniform regulations department which can provide answers to any specific uniform item questions.

12. getLink()

This is a generic name for this method used only for this document. The actual site will contain several links that will be later determined. Each link will require a method that will allow the web browser to display the desired link.

13. getMaleEnlistedIndex()

This method will be used to get the index page for the Male Enlisted subcategory. This will allow the user to navigate to any desired rank and gender.

14. getFemaleOfficerIndex()

This method will be used to get the index page for the Female Officer subcategory. This will allow the user to navigate to any desired rank and gender.

15. getMaleOfficerIndex()

This method will be used to get the index page for the Male Officer subcategory. This will allow the user to navigate to any desired rank and gender.

16. getFemaleEnlistedIndex()

This method will be used to get the index page for the Female Enlisted subcategory. This will allow the user to navigate to any desired rank and gender.

O. UNIFORMS

Each rank and gender has the same uniform names for each uniform. However, the uniforms vary for each rank and gender while the names are shared. The following methods will get the correct uniform as filtered by the rank and gender.

1. getEveningA()

This method will get the Evening A HTML page.

2. **getEveningB()**

This method will get the Evening B HTML page.

3. **getBlueDressA()**

This method will get the Blue Dress A HTML page.

4. **getBlueDressB()**

This method will get the Blue Dress B HTML page.

5. **getBlueDressC()**

This method will get the Blue Dress C HTML page.

6. **getBlueDressD()**

This method will get the Blue Dress D HTML page.

7. **getBlueWhiteDressA()**

This method will get the Blue White Dress A HTML page.

8. **getBlueWhiteDressB()**

This method will get the Blue White Dress B HTML page.

9. **getServiceA()**

This method will get the Service A HTML page.

10. **getServiceB()**

This method will get the Service B HTML page.

11. **getServiceC()**

This method will get the Service C HTML page.

12. **getWoodland()**

This method will get the Woodland HTML page.

13. **getDessert()**

This method will get the Dessert HTML page.

P. **UNIFORM STYLES**

1. **getOptionalItems()**

Each rank and gender has different optional items for each uniform. This method will be used to get the optional items for the selected uniform as filtered by the selected rank and gender.

2. getDetails()

Each uniform has its own set of detailed measurements and specifications that are also dependent on rank and gender. This method will be used to get the details for the selected uniform as filtered by the selected rank and gender.

Q. TYPICAL USE

- The user desires the measurements of a particular uniform.
- User will locate web presence at the assigned URL.
- User will log in with user name and password.
- The system will filter based on the stored rank and gender for the user and send the appropriate subcategory index page to the web browser.
- The user will select “Uniforms” from the navigation bar.
- The system will send the Uniforms HTML page to the user’s web browser.
- As the user is scrolling the list of uniforms, a photograph of the uniform will be displayed in the “Uniform Picture” section.
- Once the appropriate uniform has been found, the user can search the detailed section of the uniform for specific regulations or the user can view the optional items for the selected uniform.
- The exact text from the MCO will be displayed in the text area for each selected item.
- The user will end their session.

R. DETAILED DESIGN LANGUAGE

1. HTML Language Choice

Due to the nature of the web page, the language of choice for this project will be Hyper-Text Mark up Language (HTML). The majority of the pages will be constructed using this language with additional Java Script being used as necessary.

2. HTML Language Definition

The following table identifies the basic language constructs that will be used to develop this site.

A HREF	Identifies a hyperlink	<A HREF="NAME"
APPLET	Inserts a call to a JAVA applet into an HTML document	<APPLET> </APPLET>
BODY	Outlines body text	<BODY> </BODY>
BR	Line break	 </BR>
CENTER	Centers text between container	<CENTER> </CENTER>
DIV	Identifies division containers	<DIV> </DIV>
FONT	Sets font size	
H1	Identifies a level one heading, and may contain successive layers	<H1> </H1>
HTML	Begins the HTML	<HTML> </HTML>
IMG SRC=	Identifies inclusion of an image	
LI	Identifies a list item	 NO ENDING
TITLE	Identifies the title of the HTML document	<TITLE> </TITLE>
SCRIPT	Inline script	<SCRIPT> </SCRIPT>
TABLE	Creates a table	<TABLE> </TABLE>
TBODY	Defines the tables body when headers and footers are defined	<TBODY> </TBODY>
TD	Provides a table cell	<TD> </TD>
TH	Provides table headings	<TH> </TH>
TR	Provides a table row	<TR> </TR>
<!--.....-->	Comments	<!-- HI THERE -- >
SCRIPT	Inline script	<SCRIPT> </SCRIPT>

Table 1. HTML Tags

S. DESIGN AND DEFICIENCY MAINTENANCE

1. Deficiency Prioritization

Each deficiency that is found will be prioritized and worked on according to time and risk factors. The formula used for this assessment follows:

Estimated Deficiency Requirement (DR) Time / Total DR Times = DR frequency ratio

$(\text{DR frequency ratio} * \text{Priority}) * 100 = \text{Risk Factor}.$

During the initial stages of the project, we will outline a cut off Risk Factor of 50%. This value will be the determining threshold by which deficiencies will be corrected and implemented into the project. The remaining DR's from the cycle will be implemented as time permits.

2. Deficiency Risk Analysis

The following table will be used as a tracking mechanism to ensure DR's are not overlooked and are corrected in a timely manner. This chart will be used to prioritize deficiencies noted in the product, apply the above risk formula, and correct them based on risk value.

DR#	DESCRIPTION	EST HRS	RISK FREQ	PRIORITY	RISK
Totals					

Table 2. Risk Matrix

T. EARLY USABILITY ANALYSIS

1. Description of analysis subjects

We have developed paper sketches of the web interface to be used in this early usability analysis. Two subjects were chosen for the initial usability test of the web interface. The first subject was a civilian NPS student with no military experience. The

second subject was a Marine 1st Lieutenant with five years of military experience. Subjects of widely differing backgrounds and military experience were selected in order to get a true feel for the usability of the product. There was no user's manual provided, however the website gives users guided instruction on available options. The same prototype sketch was given to each subject during separate analysis sessions.

2. Rating criteria for analysis

The HCI design and judgment criteria as set forth in Section C of this document was provided and explained to the test subjects. The subjects were asked to rate the interface on a scale of 1-10 (1 being poor, and 10 being excellent). The subjects were also given the option to rate an area N/A if the subject felt the criteria could not be judged from the initial usability test. Finally, the subjects were asked for any feedback outside the focus of the given criteria.

3. Analysis

CRITERIA	RATING
Ease of use	9
Quality of information provided	10
Accuracy of information provided	N/A
Interface efficiency(i.e. minimal number of operations required to get desired info)	10
Error free design	9
Ease of navigation	8
System help function adequate	N/A
Capability to satisfy expert users	10

Table 3. Subject 1

Subject #1 was the civilian NPS student, and he thought the interface was extremely well done. He found the page was well laid out with nice drop down menus and links. The subject's inexperience with the military made the initial navigation difficult, but he felt that the interface was designed with the novice in mind. This attribute allowed him to catch on quickly. Additionally, he mentioned that the presentation of the radio buttons used on the second to last interface sketch was unclear, specifically on how many buttons could be selected. Overall, he gave it an excellent rating.

CRITERIA	RATING
Ease of use	9
Quality of information provided	10
Accuracy of information provided	10
Interface efficiency(i.e. minimal number of operations required to get desired info)	9
Error free design	9
Ease of navigation	8
System help function adequate	N/A
Capability to satisfy expert users	9







Table 4. Subject 2










Subject #2 was the Marine 1st Lieutenant, and he thought the interface was extremely well done as well. He too did not like the radio buttons used on the second to last sketch; he would prefer drop down menus. Additionally, he would prefer a larger representation of the uniform insignia presented on the last sketch. He commented that an interface like this is long overdue. Overall, he gave an excellent rating.

4. Conclusion

The initial usability test was a very positive analysis with great feedback provided by both subjects. Some of the difficulties encountered during testing were a result of utilizing a paper interface rather than a real GUI interface where navigation would potentially be more intuitive and obvious as images and hotspots appear. All recommendations will be considered and should be easy to fix and implement.

U. TABLE OF UNIFORMS

	Male Non NCO	Male NCO	Male SNCO
Evening Dress A	N/A	N/A	
Evening Dress B	N/A	N/A	Same as A
Blue Dress A	Just like NCO except without blood stripe		
Blue Dress B		Just like Non NCO except with blood Stripe	Just like Non NCO except with blood stripe
Blue Dress C	Just like NCO except without blood stripe		
Blue Dress D	Just like	Just like	Just like

	Male Non NCO	Male NCO	Male SNCO
	Blue Dress C except with short sleeve and no blood stripe	Blue Dress C except with short sleeve	Blue Dress C except with short sleeve
Blue-White Dress A			
Blue-White Dress B			
Service A Note: garrison cover can be worn instead of combination cover with all service uniforms			
Service B			
























	Male Non NCO	Male NCO	Male SNCO
Service C			
Service w Sweater	 (Officer Shown)	 (Officer Shown)	 (Officer Shown)
Woodland Utility			
Dessert Utility			

Table 5. Male Enlisted Uniforms

	Male WO/Co Grade Officer	Male Field Grade Officer	Male Flag Officer
Evening Dress A	Same as Field Grade except different cover and sleeve device		Same as Field Grade except different cover and sleeve device
Evening Dress B Note: only difference between A and B is whit waistcoat is worn with A and scarlet waistcoat or cummerbund is worn with B		Same as Flag Officer except different cover and sleeve device	
Blue Dress A	Same as Field Grade except different cover		Same as Field Grade except different cover

	Male WO/Co Grade Officer	Male Field Grade Officer	Male Flag Officer
Blue Dress B		Same as Company Grade except different cover	Same as Company Grade except different cover
Blue Dress C		Same as Company Grade except different cover	Same as Company Grade except different cover
Blue Dress D		Same as Company Grade except different cover	Same as Company Grade except different cover
Blue-White Dress A		Same as Company Grade except different cover	Same as Company Grade except different cover

	Male WO/Co Grade Officer	Male Field Grade Officer	Male Flag Officer
Blue-White Dress B		Same as Company Grade except different cover	Same as Company Grade except different cover
Service A Note: garrison cover can be worn instead of combination cover with all service uniforms	Same as Field Grade except different cover (unless garrison cover)		Same as Field Grade except different cover (unless garrison cover)
Service B	Same as Service C except with long sleeve and tie	Same as Co Grade except different cover (unless garrison cover)	Same as Co Grade except different cover (unless garrison cover)
Service C		Same as Co Grade except different cover (unless garrison cover)	Same as Co Grade except different cover (unless garrison cover)























	Male WO/Co Grade Officer	Male Field Grade Officer	Male Flag Officer
Service w Sweater			
Woodland Utility			
Dessert Utility			

Table 6. Male Officer Uniforms

	Female Non NCO	Female NCO	Female SNCO
Evening Dress A	N/A	N/A	
Evening Dress B	N/A	N/A	Same as A
Blue Dress A Note: all Blue Dress female uniforms may be worn with slacks. Non NCO slacks do not have a blood stripe.	Same as Blue Dress B except with medals	Same as Blue Dress B except with medals	Same as Blue Dress B except with medals
Blue Dress B			
Blue Dress C	Same as Blue Dress D except with long sleeve	Same as Blue Dress D except with long sleeve	Same as Blue Dress D except with long sleeve

	Female Non NCO	Female NCO	Female SNCO
Blue Dress D			
Blue-White Dress A	Same as Blue Dress A except with white slacks or white skirt.	Same as Blue Dress A except with white slacks or white skirt.	Same as Blue Dress A except with white slacks or white skirt.
Blue-White Dress B	Same as Blue Dress A except with white slacks or white skirt.	Same as Blue Dress A except with white slacks or white skirt.	Same as Blue Dress A except with white slacks or white skirt.
Service A Note: garrison cover can be worn instead of combination cover with all service uniforms			
Service B			



















	Female Non NCO	Female NCO	Female SNCO
Service C	 <p>(Officer Shown)</p>	 <p>(Officer Shown)</p>	 <p>(Officer Shown)</p>
Service w Sweater			
Woodland Utility			
Dessert Utility			

Table 7. Female Enlisted Uniforms

	Female WO/ Co Grade Officer	Female Field Grade Officer	Female Flag Officer
Evening Dress A	Same as Field Grade except for different sleeve insignia		Same as Field Grade except for different sleeve. Also scarlet waistcoat and plain front shirt are worn by Flag Officers.
Evening Dress B	Same as A	Same as A	Same as A
Blue Dress A Note: all Blue Dress female uniforms may be worn with slacks.	Same as Field Grade except different cover.		Same as Field Grade except different cover.
Blue Dress B	Same as Blue Dress A except with ribbons and badges.	Same as Blue Dress A except with ribbons and badges.	Same as Blue Dress A except with ribbons and badges.
Blue Dress C		Same as Co Grade except different cover.	Same as Co Grade except different cover.

	Female WO/ Co Grade Officer	Female Field Grade Officer	Female Flag Officer
Blue Dress D	 <p>(Enlisted Shown)</p>	Same as Co Grade except different cover.	Same as Co Grade except different cover.
Blue-White Dress A	Same as Blue Dress A except with white slacks or white skirt.	Same as Blue Dress A except with white slacks or white skirt.	Same as Blue Dress A except with white slacks or white skirt.
Blue-White Dress B	Same as Blue Dress A except with white slacks or white skirt.	Same as Blue Dress A except with white slacks or white skirt.	Same as Blue Dress A except with white slacks or white skirt.
Service A Note: garrison cover can be worn instead of combination cover with all service uniforms		Same as Co Grade except with different cover.	Same as Co Grade except with different cover.
Service B	 <p>(Enlisted Shown)</p>	Same as Co Grade except with different cover.	Same as Co Grade except with different cover.











	Female WO/ Co Grade Officer	Female Field Grade Officer	Female Flag Officer
Service C	Same as Field Grade except with different cover.		Same as Field Grade except with different cover.
Service w Sweater			
Woodland Utility			
Dessert Utility			

Table 8. Female Officer Uniforms

III. WEB DESIGN CHECKLIST

Name:	Date:
Rank:	MOS:
Navigation There is a clear indication of the current location There is a clearly-identified link to the Home page All major parts of the site are accessible from the Home page If necessary, a site map is available Site structure is simple, with no unnecessary levels If necessary, an easy-to-use Search function is available You can tell where you are immediately (clear title, description, image captions, etc.) There is an index, table of contents, or some other clear indicator of the contents of the site. User is able to move around within the site with ease Directions for using the site are provided and are easily understandable The links to other pages within the site are helpful and appropriate All links are current	Compliance Always Sometimes Never Notes
Speed No unnecessarily large graphics (slow download time) Server does not appear to be slow or often inaccessible All pages/links load in a timely manner	Compliance Always Sometimes Never Notes
Design ALT tags are used for all graphics, especially navigation graphics Black text on white background whenever possible for optimal legibility Plain-color backgrounds or extremely subtle background patterns Text is in a printable color Navigation in a consistent location	Compliance Always Sometimes Never Notes

<p>A familiar location for navigation bars</p> <p>The design keeps from scrolling horizontally</p> <p>One axis of symmetry for centered text on a page</p> <p>Scrolling is encouraged by splitting an image at the fold</p> <p>There is sufficient information to make the site worth visiting</p> <p>The information is clearly labeled and organized</p> <p>The same basic format is used consistently throughout site</p> <p>Information is easy to find (no more than three clicks, for example)</p> <p>Lists of links are well organized and easy to use</p> <p>User is able to quickly determine the basic content of the site.</p> <p>User is able to determine the intended audience of the site.</p> <p>The language used is simple and appropriate for the intended users</p> <p>The layout is clear</p> <p>Unnecessary animation is avoided</p>	
--	--

<i>Information</i>	<i>Compliance</i> <i>Always Sometimes Never Notes</i>
<p>The author(s) of the material on the site is clearly identified</p> <p>Information about the author(s) is available</p> <p>Author(s) appears qualified to present information on this topic</p> <p>The sponsor of the site is clearly identified</p> <p>A contact person or address is available so the user can ask questions or verify information</p> <p>Latest revision date is provided</p> <p>Content is updated frequently</p> <p>The purpose of this site is clear: business/commercial, entertainment, informational, news, personal page, persuasion</p> <p>The content achieves its intended purpose effectively</p> <p>The content appears to be complete (no "under construction" signs, for example)</p> <p>The content of this site is well organized</p> <p>The information in this site is easy to understand</p>	

<p>This site offers sufficient information related to its purposes</p> <p>The content is free of bias, or the bias can be easily detected</p> <p>This site provides interactivity that increases its value</p> <p>The information appears to be accurate based on user's previous knowledge of subject</p> <p>The information is consistent with similar information in other sources</p> <p>Grammar and spelling are correct</p>	
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Table 9. Web Design Checklist

IV. TESTING

USMC Web Based Uniform Regulations **Initial Testing Scenarios**

1. Please state your name, rank, MOS, and years experience.
2. As you are going through this testing, please comment, positively or negatively, out loud regarding some of the following:
 - a. Overall design
 - b. Color scheme
 - c. Navigation
 - d. Accuracy of the information
 - e. Text font and size
 - f. Ease or difficulty of using the site
 - g. Make any other comments that you feel will be helpful
3. Although you may know the answer to the following scenarios off the top of your head, please use the web site to find the answers.
4. You do not need to write down any answers, just simply keep a running dialog as you are working through the scenarios.
5. What is the size of the hem on the trousers of the Service Dress C?
6. Where does the Service Badge go on the Evening Dress B?
7. Are you allowed to wear a flight jacket with the Blue Dress D?
8. What are the measurements for a moustache?
9. Are you required to wear ribbons with the Service Dress B?
10. Where does the USMC emblem go on the pt gear sweatshirt?
11. Find the requirements for Food Service Clothing.
12. When are you required to wear your sleeves up on the Utility uniform?
13. Please feel free to browse the site as you wish and make comments out loud.
14. Please fill out our survey.

15. Thank you very much for participating in the testing of this site. Your input is invaluable to the functionality and success of this web site.

Name: Test Subject 1	Date: 11 May 2006			
Rank: Captain	MOS: 0602			
Navigation	Compliance			
	Always	Sometimes	Never	Notes
There is a clear indication of the current location	x			
There is a clearly-identified link to the Home page	x			
All major parts of the site are accessible from the Home page		x		You have to go to rank/gender page to get access to the real information
If necessary, a site map is available		x		
Site structure is simple, with no unnecessary levels	x			
If necessary, an easy-to-use Search function is available		x		
You can tell where you are immediately (clear title, description, image captions, etc.)		x		
There is an index, table of contents, or some other clear indicator of the contents of the site.	x			
User is able to move around within the site with ease	x			
Directions for using the site are provided and are easily understandable		x		
The links to other pages within the site are helpful and appropriate		x		Links were inactive during the testing
All links are current		x		

Speed	Compliance			
	Always	Sometimes	Never	Notes
No unnecessarily large graphics (slow download time)	<u>x</u>			
Server does not appear to be slow or often inaccessible	<u>x</u>			
All pages/links load in a timely manner	<u>x</u>			

Design	Compliance			
	Always	Sometimes	Never	Notes
ALT tags are used for all graphics, especially navigation graphics	<u>x</u>			
Black text on white background whenever possible for optimal legibility		<u>x</u>		
Plain-color backgrounds or extremely subtle background patterns				
Text is in a printable color	<u>x</u>			
Navigation in a consistent location	<u>x</u>			
A familiar location for navigation bars	<u>x</u>			

The design keeps from scrolling horizontally	<u>X</u>		
One axis of symmetry for centered text on a page	<u>X</u>		
Scrolling is encouraged by splitting an image at the fold			
There is sufficient information to make the site worth visiting	<u>X</u>		
The information is clearly labeled and organized	<u>X</u>		
The same basic format is used consistently throughout site	<u>X</u>		
Information is easy to find (no more than three clicks, for example)	<u>X</u>		
Lists of links are well organized and easy to use		<u>X</u>	<u>No active links</u>
User is able to quickly determine the basic content of the site.	<u>X</u>		
User is able to determine the intended audience of the site.	<u>X</u>		
The language used is simple and appropriate for the intended users	<u>X</u>		
The layout is clear	<u>X</u>		
Unnecessary animation is avoided	<u>X</u>		

<i>Information</i>	<i>Compliance</i> <i>Always Sometimes Never Notes</i>		
The author(s) of the material on the site is clearly identified	<u>X</u>		
Information about the author(s) is available			<u>Not sure</u>
Author(s) appears qualified to present information on this topic			<u>I don't know about zee German.</u>
The sponsor of the site is clearly identified			<u>I don't know</u>
A contact person or address is available so the user can ask questions or verify information			
Latest revision date is provided			
Content is updated frequently			<u>Don't know</u>
The purpose of this site is clear: business/commercial, entertainment, informational, news, personal page, persuasion	<u>X</u>		
The content achieves its intended purpose effectively	<u>X</u>		
The content appears to be complete (no "under construction" signs, for example)	<u>X</u>		
The content of this site is well organized	<u>X</u>		
The information in this site is easy to understand	<u>X</u>		
This site offers sufficient information	<u>X</u>		

related to its purposes	
The content is free of bias, or the bias can be easily detected	<u>X</u>
This site provides interactivity that increases its value	<u>Not yet</u>
The information appears to be accurate based on user's previous knowledge of subject	<u>X</u>
The information is consistent with similar information in other sources	<u>X</u>
Grammar and spelling are correct	<u>X</u>

Table 10. Test Subject 1

Name: Test Subject 2	Date: 11 May 2006
Rank: Captain	MOS: 0602
Navigation	Compliance
	Always Sometimes Never
	Notes
There is a clear indication of the current location	x
There is a clearly-identified link to the Home page	x
All major parts of the site are accessible from the Home page	x
If necessary, a site map is available	x
Site structure is simple, with no unnecessary levels	x
If necessary, an easy-to-use Search function is available	x Didn't see a search field
You can tell where you are immediately (clear title, description, image captions, etc.)	x
There is an index, table of contents, or some other clear indicator of the contents of the site.	x Liked across top
User is able to move around within the site with ease	x
Directions for using the site are provided and are easily understandable	x
The links to other pages within the site are helpful and appropriate	x
All links are current	x

Design	Compliance
	Always Sometimes Never
	Notes
ALT tags are used for all graphics, especially navigation graphics	x Didn't recall any
Black text on white background whenever possible for optimal legibility	x
Plain-color backgrounds or extremely subtle background patterns	x
Text is in a printable color	x
Navigation in a consistent location	x
A familiar location for navigation bars	x
The design keeps from scrolling horizontally	x + boxes
One axis of symmetry for centered text on a page	x
Scrolling is encouraged by splitting an image at the fold	x

There is sufficient information to make the site worth visiting	<u>X</u>	
The information is clearly labeled and organized		<u>X</u>
The same basic format is used consistently throughout site	<u>X</u>	
Information is easy to find (no more than three clicks, for example)	<u>X</u>	
Lists of links are well organized and easy to use	<u>X</u>	
User is able to quickly determine the basic content of the site.	<u>X</u>	
User is able to determine the intended audience of the site.	<u>X</u>	
The language used is simple and appropriate for the intended users	<u>X</u>	
The layout is clear	<u>X</u>	
Unnecessary animation is avoided	<u>X</u>	

Information	Compliance			Notes
	<i>Always</i>	<i>Sometimes</i>	<i>Never</i>	
The author(s) of the material on the site is clearly identified	<u>X</u>			
Information about the author(s) is available			<u>X</u>	
Author(s) appears qualified to present information on this topic			<u>X</u>	
The sponsor of the site is clearly identified	<u>X</u>			
A contact person or address is available so the user can ask questions or verify information			<u>X</u>	<u>Didn't see contact link</u>
Latest revision date is provided			<u>X</u>	
Content is updated frequently		<u>X</u>		<u>unknown</u>
The purpose of this site is clear: business/commercial, entertainment, informational, news, personal page, persuasion	<u>X</u>			
The content achieves its intended purpose effectively	<u>X</u>			
The content appears to be complete (no "under construction" signs, for example)		<u>X</u>		
The content of this site is well organized	<u>X</u>			
The information in this site is easy to understand		<u>X</u>		<u>Uniform man unclear</u>
This site offers sufficient information related to its purposes	<u>X</u>			
The content is free of bias, or the bias can be easily detected	<u>X</u>			
This site provides interactivity that increases its value		<u>X</u>		
The information appears to be accurate based on user's previous knowledge of	<u>X</u>			

subject The information is consistent with similar information in other sources Grammar and spelling are correct	<u>X</u>	<u>X</u>	<u>Inches “</u>
---	----------	----------	-----------------

Table 11. Test Subject 2

Name:Test Subject 3	Date:11 May 2006		
Rank:LtCol	MOS:7562		
Navigation	Compliance		
	Always	Sometimes	Never Notes
There is a clear indication of the current location	X		
There is a clearly-identified link to the Home page	X		
All major parts of the site are accessible from the Home page	X		
If necessary, a site map is available		X	Didn't see one
Site structure is simple, with no unnecessary levels	X		
If necessary, an easy-to-use Search function is available		X	Didn't see one
You can tell where you are immediately (clear title, description, image captions, etc.)	X		
There is an index, table of contents, or some other clear indicator of the contents of the site.	X		
User is able to move around within the site with ease	X		
Directions for using the site are provided and are easily understandable		X	No directions necessary
The links to other pages within the site are helpful and appropriate	X		
All links are current		X	Not all links operational

Speed	Compliance		
	Always	Sometimes	Never Notes
No unnecessarily large graphics (slow download time)	X		
Server does not appear to be slow or often inaccessible	X		
All pages/links load in a timely manner	X		

Design	Compliance		
	Always	Sometimes	Never Notes
ALT tags are used for all graphics, especially navigation graphics			Didn't notice
Black text on white background whenever possible for optimal legibility	X		
Plain-color backgrounds or extremely subtle background patterns	X		

Text is in a printable color	X	No horizontal scrolling implemented
Navigation in a consistent location	X	
A familiar location for navigation bars	X	
The design keeps from scrolling horizontally	X	
One axis of symmetry for centered text on a page	X	
Scrolling is encouraged by splitting an image at the fold		
There is sufficient information to make the site worth visiting	X	
The information is clearly labeled and organized	X	
The same basic format is used consistently throughout site	X	
Information is easy to find (no more than three clicks, for example)	X	
Lists of links are well organized and easy to use	X	
User is able to quickly determine the basic content of the site.	X	
User is able to determine the intended audience of the site.	X	
The language used is simple and appropriate for the intended users	X	
The layout is clear	X	
Unnecessary animation is avoided	X	

Information	Compliance			
	<i>Always</i>	<i>Sometimes</i>	<i>Never</i>	<i>Notes</i>
The author(s) of the material on the site is clearly identified	X			
Information about the author(s) is available		X		Didn't see addt'l info
Author(s) appears qualified to present information on this topic	X			
The sponsor of the site is clearly identified		X		Didn't see a sponsor
A contact person or address is available so the user can ask questions or verify information		X		Didn't see contact info
Latest revision date is provided		X		Didn't see one
Content is updated frequently		X		Unknown
The purpose of this site is clear: business/commercial, entertainment, informational, news, personal page, persuasion	X			
The content achieves its intended purpose effectively	X			
The content appears to be complete (no "under construction" signs, for example)	X			

The content of this site is well organized	X
The information in this site is easy to understand	X
This site offers sufficient information related to its purposes	X
The content is free of bias, or the bias can be easily detected	X
This site provides interactivity that increases its value	X
The information appears to be accurate based on user's previous knowledge of subject	X
The information is consistent with similar information in other sources	X
Grammar and spelling are correct	X

Table 12. Test Subject 3

Name: Test Subject 4	Date: 11 May 2006
Rank: Capt	MOS: 0180
Navigation	Compliance
	Always Sometimes Never Notes
There is a clear indication of the current location	X
There is a clearly-identified link to the Home page	X
All major parts of the site are accessible from the Home page	X
If necessary, a site map is available	X
Site structure is simple, with no unnecessary levels	X
If necessary, an easy-to-use Search function is available	X Would be nice to easily find information
You can tell where you are immediately (clear title, description, image captions, etc.)	X
There is an index, table of contents, or some other clear indicator of the contents of the site.	X
User is able to move around within the site with ease	X
Directions for using the site are provided and are easily understandable	X
The links to other pages within the site are helpful and appropriate	X Link to previous page was placed in different locations
All links are current	X
Speed	Compliance
	Always Sometimes Never Notes
No unnecessarily large graphics (slow download time)	X

Server does not appear to be slow or often inaccessible	<u>X</u>	
All pages/links load in a timely manner	<u>X</u>	<u>Hard to say since the pages were local</u>

<i>Design</i>	<i>Compliance</i> <i>Always Sometimes Never Notes</i>		
ALT tags are used for all graphics, especially navigation graphics		<u>X</u>	<u>Should be descriptive. The text on a few of the graphic images were difficult to read</u>
Black text on white background whenever possible for optimal legibility	<u>X</u>		
Plain-color backgrounds or extremely subtle background patterns		<u>X</u>	<u>Good water marks</u>
Text is in a printable color	<u>X</u>		
Navigation in a consistent location		<u>X</u>	<u>Link to previous page</u>
A familiar location for navigation bars		<u>X</u>	<u>The back to top link was buried in the bottom of the page</u>
The design keeps from scrolling horizontally	<u>X</u>		
One axis of symmetry for centered text on a page	<u>X</u>		
Scrolling is encouraged by splitting an image at the fold			<u>Ignored</u>
There is sufficient information to make the site worth visiting		<u>X</u>	<u>References specific items in text, but forces user to consult reference</u>
The information is clearly labeled and organized		<u>X</u>	
The same basic format is used consistently throughout site	<u>X</u>		
Information is easy to find (no more than three clicks, for example)		<u>X</u>	
Lists of links are well organized and easy to use		<u>X</u>	
User is able to quickly determine the basic content of the site.	<u>X</u>		
User is able to determine the intended audience of the site.		<u>X</u>	
The language used is simple and appropriate for the intended users		<u>X</u>	<u>The order is difficult.</u>
The layout is clear	<u>X</u>		
Unnecessary animation is avoided	<u>X</u>		

Information	Compliance			
	<i>Always</i>	<i>Sometimes</i>	<i>Never</i>	<i>Notes</i>
The author(s) of the material on the site is clearly identified	<u>X</u>			
Information about the author(s) is available			<u>X</u>	
Author(s) appears qualified to present information on this topic		<u>X</u>		
The sponsor of the site is clearly identified	<u>X</u>			
A contact person or address is available so the user can ask questions or verify information			<u>X</u>	
Latest revision date is provided			<u>X</u>	
Content is updated frequently				<u>Under Development</u>
The purpose of this site is clear: business/commercial, entertainment, informational, news, personal page, persuasion	<u>X</u>			
The content achieves its intended purpose effectively	<u>X</u>			
The content appears to be complete (no “under construction” signs, for example)		<u>X</u>		
The content of this site is well organized		<u>X</u>		
The information in this site is easy to understand		<u>X</u>		
This site offers sufficient information related to its purposes		<u>X</u>		
The content is free of bias, or the bias can be easily detected	<u>X</u>			
This site provides interactivity that increases its value	<u>X</u>			
The information appears to be accurate based on user’s previous knowledge of subject		<u>X</u>		
The information is consistent with similar information in other sources		<u>X</u>		
Grammar and spelling are correct		<u>X</u>		<u>Few typos</u>

Table 13. Test Subject 4

V. XHTML (HTML AND CSS) CODE EXAMPLE

The following code contains the full CSS style sheet, the code for the start page and exemplary the code one of the uniform pages. And while the CSS code is rather extensive the very similar HTML of the start page and the Uniform page demonstrate the simple include statements used to assemble the output HTML files.

A. CSS

```
body {
    font-family: Arial, Helvetica, sans-serif;
    color:#0A0A0A;
    background: #F0F0F0 url(../images/Emblem_backgriund.gif) no-repeat fixed 0%
65% !important;
    background: #F0F0F0 url(../images/Emblem_backgriund.gif) no-repeat scroll -1%
340px ;
    behavior: url(/css/csshover2.htc);
}

* {padding:0;margin:0;}

table {
    font-family: Arial, Helvetica, sans-serif;
    font-size: 11px;
    line-height:15px;
    border-top:1px solid #000000;
    border-right:1px solid #000000;
    border-collapse: collapse;
}

tr {
    border: 1px solid #000000;
}

td {
    padding:2px;
    border: 1px solid #000000;
}

#container {
```

```

        width:90%;
        min-width: 670px;
        margin: 10px auto auto 30px;
        border-top-width: 10px;
        border-top-style: solid;
        border-top-color: #0A0A0A;
        border-bottom-width: 10px;
        border-bottom-style: solid;
        border-bottom-color: #990000;
        background: #FEFEFE url(..images/Emblem_backgriund.gif) no-repeat fixed 0%
65% !important;
        background: #FEFEFE url(..images/Emblem_backgriund.gif) no-repeat scroll -
35px 320px ;
    }
    #logo {
        margin: 0px;
        padding: 0px;
        height: 90px;
        background-attachment: scroll;
        background-image: url(..images/logo_mod.gif);
        background-repeat: repeat-x;
        background-position: left ;
        background-color: #0A0A0A;
    }

    #Few_proud_logo{
        float:left;
    }

    #logo #page_title {
        float: right;
        margin-right: 10px;
        padding-top:3.5em;
        font-family: Arial, Helvetica, sans-serif;
        font-style: normal;
        font-weight: bold;
        text-transform: uppercase;
        color: #FEFEFE;
    }

    #top_nav {
        width:100%;
        height:21px;
        background-color:#0A0A0A;

```



```

padding:0px;
float: left;
border-bottom-width: 1em;
border-bottom-style: solid;
border-bottom-color: #990000;
}
/*Only for the start page welcome banner*/
#navlist {
font-family: Arial, Helvetica, sans-serif;
font-size: 12px;
font-style: normal;
font-weight: 600;
text-transform: uppercase;
text-align: center;
letter-spacing:0.07em;
color: #FEFEFE;
margin-top: 3px;
margin-bottom: 3px;
}

#breadcrumb {
background-color:#990000;
color:#FEFEFE;
margin: 5px 0px 2px;
padding: 0px;
line-height: normal;
font-family: Geneva, Arial, Helvetica, sans-serif;
text-decoration: none;
text-indent: 10px;
font-size: 12px;
}

#breadcrumb a {

color: #FEFEFE;
text-decoration: underline;
}

#left_nav {
margin: 1em 0em 0em;
padding: 0px;
float: left;
width: 20%;

```

```
}  
#pic_col {  
    float: left;  
    width: 55%;  
    padding-top: 10px;  
}
```

```
#pic_col .image_text{  
    margin-left:30%;  
    font-size:.8em;  
}
```

```
#pic_col .image_text_small{  
    margin-left:30%;  
    font-size:.6em;  
}
```

```
#pic_col .cover_pictures{  
float:left;  
}
```

```
#pic_col .cover_pictures p{  
font-size:11px;  
margin-left:20%;  
}
```

```
#right_col {  
    width:20%;  
    margin: 5px 0px 0px;  
    padding: 0px 3px 20px 5px;  
    clear: none;  
    float: right;  
    font-family: Arial, Helvetica, sans-serif;  
    font-size: 12px;  
    font-style: normal;  
    font-weight: normal;  
}
```

```

#details {
    margin-bottom: 10px;
    padding: 0px;
    font-size: 1.3em;
    display: none;
}
#details_local {
    margin-bottom: 10px;
    padding: 0px;
    font-size: 1.3em;
    display: none;
}
#optional_items {
    margin: 0px;
    font-size: 1.3em;
    display: none;
}
#detailed_text {
    margin: 0px ;
    padding: 10px 30px 5px;
    clear: both;
    font-family: Arial, Helvetica, sans-serif;
    font-size: 14px;
    font-style: normal;
    font-weight: normal;
    font-variant: normal;
    color: #0A0A0A;
    border-top-width: 1px;
    border-top-style: dotted;
    border-top-color: #0A0A0A;
    list-style-position: outside;
}

#detailed_text h3{
    margin-top: 5px;
}

#detailed_text ol li{
    margin-top: 5px;
}

#detailed_text ol li ol li{
    margin-top: 2px;
    list-style-position: inside;
}

```

```

#detailed_text ol li ol li ol{
    margin-left:10px;
    margin-top:2px;
    list-style-position:inside;
}

#footer {
    margin: 0px;
    padding: 0px 0px 0px 5px;
    color:#FFFFFF;
    background-color: #0A0A0A;
    clear: both;
    border-top-width: thin;
    border-top-style: solid;
    border-top-color: #000000;
    height: 20px;
}

#copy p{
    height:100%;
    margin: 0px;
    padding: 0px;
    background-color: #0A0A0A;
    clear:both;
    text-align: left;
    float: left;
    font-family: Arial, Helvetica, sans-serif;
    font-size: 12px;
    font-style: normal;
    line-height: normal;
    font-weight: lighter;
    text-transform: none;
    color: #FEFEFE;
    vertical-align: middle;
}

/*-----*/
/*
                ext_links
*/
/*-----*/

#ext_nav #int_navlist {
    float:left;
    margin-left:5em;
}

```

```

#ext_nav #ext_navlist {
    float:right;
    margin-right:10px;
}

#ext_nav ul {
    text-align: center;
    background-color: #0A0A0A;
    font-family: Arial, Helvetica, sans-serif;
    /*      line-height: 5px; */
    margin: 0px;/* fixes Firefox 0.9.3 */
    padding-top: 2px;
    padding-bottom: 2px;
    font-size: 12px;
}

#ext_nav ul li
{
    display: inline;
    padding-left: 0;
    padding-right: 0;
    padding-bottom: 2px;
    /* matches link padding except for left and right */
    padding-top: 2px;
}

#ext_nav ul li a
{
    padding-left: 10px;
    padding-right: 10px;
    padding-bottom: 5px;
    padding-top: 5px;
    color: #FEFEFE;
    text-decoration: none;
    border-right: 1px solid #FEFEFE;
    border-left-width: 1px;
    border-left-style: solid;
    border-left-color: #FEFEFE;
}

#ext_nav ul li a:hover
{
    background-color: #990000;
    color: #FEFEFE;
    border: thin solid #FEFEFE;
}

```

```

/*-----*/
/*
            drop_down
                                */
/*-----*/

/* the horizontal menu starts here */
div#listmenu {
    width:100%;
    font-size:0.75em;    /* SET FONT-SIZE HERE */
    margin-top:2px;
    margin-bottom: 2px;
    z-index: 1;
    font-weight: bold;
}
div#listmenu ul {
    margin:0 0 0 10%;/* indents ul from edge of container - NOTE: diff value for IE
in hacks below */

}
div#listmenu li {

    float:left;    /* causes the list to align horizontally instead of stack */
    position:relative; /* positioning context for the absolutely positioned drop-down
*/
    list-style-type:none; /* removes the bullet off each list item */
    background-color:#0A0A0A; /*sets the background of the menu items */
    border-right:1px solid #FEFEFE; /* creates dividing lines between the li elements
*/
    z-index: 1;
}
div#listmenu li:first-child {
    border-left:1px solid #FEFEFE; /*the first vertical line on the menu */
}

div#listmenu li:hover {
    background-color:#990000; /*sets the background of the menu items */
    border-left-width: 1px;
    border-left-style: solid;
    border-left-color: #FEFEFE;
}
div#listmenu a {
display:block;
padding:2px 6px; /*creates space each side of menu item's text */

```

```

        text-decoration:none; /* removes the underlining of the link */
        color:#FEFEFE;      /* sets the type color */
    }
div#listmenu a:hover {
    color:#FEFEFE;
}
/* the menu ends here */
/* the drop-down starts here */
div#listmenu ul li ul {
    margin:0px;
    z-index:10; /* puts drop-down on top of div - Safari needs this as menu is 1px
higher */
    position:absolute; /* positions the drop-down ul in relation to its relatively
positioned li parent */
    width:10em; /*sets the width of the menu - in combo with the li's 100% width,
makes the menu stack*/
    border-right:0; /* stops SCBs drops having two right borders - they inherit the
border, IE doesn't */
    left:-1px; /*aligns the drop exactly under the menu */
}
div#listmenu ul li ul li {padding:0;
    width:100%; /* makes the list items fill the list container (ul) */
    border-left:1px solid #FEFEFE; /* three sides of each drop-down item */
    border-bottom:1px solid #FEFEFE;
    border-right:1px solid #FEFEFE;}
div#listmenu ul li ul li a {padding:1px .5em;}
div#listmenu ul li ul li:first-child {
    border-top:1px solid #FEFEFE; /*the top edge of the dropdown */
}
/* make the drop-down display as the menu is rolled over */
div#listmenu ul li ul {display:none;} /* conceals the drop-down when menu not hovered
*/
div#listmenu ul li:hover ul {display:block; } /* shows the drop-down when the menu is
hovered */

/* pop-out starts here */
body div#listmenu ul li ul li ul {
    position:absolute;
    visibility:hidden; /* same effect as display:none in this situation */
    top:-1px;
    left:10em;
}
div#listmenu ul li ul li:hover ul {visibility:visible;} /* same effect as display:block in this
situation */

/* second level popouts start here*/

```

```
div#listmenu ul li ul li:hover ul li ul {visibility:hidden;}
div#listmenu ul li ul li ul li:hover ul {visibility:visible;} /* same effect as display:block in
this situation */
```

```
/* THE HACK ZONE - */
```

```
/* hack for IE (all flavors) so the menu has a vertical line on the left */
```

```
* html div#listmenu ul {
    float:left; /* makes the ul wrap the li's */
    border-left:1px solid #FEFEFE; /* adds the rightmost menu vertical line to the ul
*/
    margin-left:5%; /* IE doubles the given value above - why? */
}
```

```
/* add a top line to drops and pops in IE browsers - can't read :first-child */
```

```
* html div#listmenu ul li ul {
    border-top:1px solid #FEFEFE;
    border-left:0px; /* stops the drop inheriting the ul border */
}
```

```
/* the Tantek hack to feed IE Win 5.5-5.0 a lower value to get the pop-out to touch the
drop-down */
```

```
* html div#listmenu ul li ul li ul {
    left:9.85em;
    voice-family: "\"}\"";
    voice-family:inherit;
    left:10em;
}
```

```
/* and the "be nice to Opera and Firefox(ck)" rule */
```

```
html>body div#listmenu ul li ul li ul {
    left:10em;
}
```

```
/* an Opera-only hack to fix a redraw problem by invisibly extending the ul */
```

```
/* the first-level drop stays open for 100px below the bottom but at least it works */
```

```
/* this can be reduced to as little as 22px if you don't have pop-outs */
```

```
/* the pop-out menu stays open for 22px below the bottom but at least it works */
```

```
@media all and (min-width: 0px){
    body div#listmenu ul li ul {padding-bottom:100px;}
    body div#listmenu ul li ul li ul {padding-bottom:22px;}
    ul li ul li ul li ul li ul li:hover {visibility:visible;} /* same effect as display:block in this
situation */
```

```
}
```

```
/*end Opera hack */
```

```
/* END OF HACK ZONE */
```

```
/* the drop-down ends here */
```

```
/* END OF LIST-BASED MENU */
```



```

/* finally after feeding values to all others, we deal with MAc5 IE */
/* IE5 Mac can't do drop-downs so we need to present the info in a different way*/
/* we present the drop down choices in a row and never show any second-level drops */
/* this stylesheet is read by IE5 Mac only - hack omits 'url' and leave no space between
@import and (" */

```

```

/*-----*/
/*                left_nav                                */
/*                                                                */
/*-----*/

```

```

.menu {
    width: 75%;
}
#right_col .menu{
    margin-top:10px;
    float:right;
}

```

```

.menu ul {
    list-style: none;
    margin: 0;
    padding: 0;
}

```

```

.menu a, .menu h2 {
    font: bold 16px arial, helvetica, sans-serif;
    display: block;
    border-width: 1px;
    border-style: solid;
    border-color: #ccc #888 #555 #bbb;
    margin: 0;
    padding: 2px 3px;
}

```

```

.menu h2 {
    color: #FEFEFE;
    background: #0A0A0A;
    text-transform: uppercase;
}

```

```

.menu #present{
    color: #FEFEFE ;
}

```

```
        background: #990000;
        text-decoration: none;
    }
```

```
.menu a {
    color: #FEFEFE ;
    background: #313643;
    text-decoration: none;
}
```

```
.menu a:hover {
    color: #FEFEFE;
    background:#990000;
}
```

```
.menu li {
    position: relative;
}
```

```
.lower_list{
    margin-top:1em;
}
```

```
#validation {position:relative;
               top:70px;
               left:30px;
}
```

```
/*-----*/
/*                                     hacks for the vertical nav menu
*/
/*-----*/
```

```
[if IE]>
    .menu ul li {float: left; width: 100%;}
```

```
<![endif]
[if lt IE 7]>
```

```
.menu ul li {float: left; width: 100%;}
```

```
.menu ul li a {height: 1%;}

.menu a, .menu h2 {
    font: bold 0.7em/1.4em arial, helvetica, sans-serif;
}

<![endif]
```

B. HTML AND PHP OF START PAGE

1. Index Page

```
<?php $serverRoot = $_SERVER['DOCUMENT_ROOT']; ?>

<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
"http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<!-- saved from url=(0014)about:internet -->
<html xmlns="http://www.w3.org/1999/xhtml">
<head>
    <meta http-equiv="Content-Type" content="text/html; charset=iso-8859-1" />
    <title>The Marine Corps Online Uniform Manual</title>

    <link href="css/level_style.php" rel="stylesheet" type="text/css" />

</head>

<body>

<?php $includeFile = $serverRoot.'/start_content.php';
if
(file_exists($includeFile) && is_readable($includeFile)){

    include($includeFile); } ?>

</body>
</html>
```

2. Content of start page

```
<?php $serverRoot = $_SERVER['DOCUMENT_ROOT']; ?>

<div id="container">
    <div id="logo"><a name="pageTop"></a>
```

```

<div id="Few_proud_logo"></div>

```

```

<div id="page_title"><?php $includeFile = 'page_title.php';
if
(file_exists($includeFile) && is_readable($includeFile)){

include($includeFile); } ?></div>
</div>

```

```

<div id="top_nav">
<?php $includeFile = 'banner.htm';
if
(file_exists($includeFile) && is_readable($includeFile)){

include($includeFile); } ?>

</div>

```

```

<div id="left_nav">
<?php $includeFile = $serverRoot.'/navigation/left_nav.php';
if
(file_exists($includeFile) && is_readable($includeFile)){

include($includeFile); } ?>
</div>

```

```

<div id="pic_col"></div>

```

```

<div id="right_col">
<div id="details">
<?php $includeFile =
$serverRoot.'/right_col_details/uniform_details.html';
if
(file_exists($includeFile) && is_readable($includeFile)){

include($includeFile); } ?></div>

```

```

<div id="optional_items">
<?php $includeFile = $serverRoot.'/optionalItems/optional_items.html';
if
(file_exists($includeFile) && is_readable($includeFile)){

include($includeFile); } ?></div>
</div>

```

```

<div id="detailed_text">
    <?php $includeFile = 'bottom_text/bottom.htm';
    if
(file_exists($includeFile) && is_readable($includeFile)){

        include($includeFile); } ?></div>

<div id="footer">
    <div id="copy"><?php $includeFile = $serverRoot.'/copyright.php';
    if
(file_exists($includeFile) && is_readable($includeFile)){

        include($includeFile); } ?></div>

    <div id="ext_links"><?php $includeFile = $serverRoot.'/navigation/ext_links.htm';
    if
(file_exists($includeFile) && is_readable($includeFile)){

        include($includeFile); } ?></div>
</div>
</div>

<div id="validation">
<p>
    <a href="http://validator.w3.org/check?uri=referer"></a>

    <a href="http://www.php.net/">
    </a>
</p>

</div>

```

3. Uniform Page Example

```

<?php $serverRoot = $_SERVER['DOCUMENT_ROOT']; ?>

<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
"http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<!-- saved from url=(0014)about:internet -->

```

```

<html xmlns="http://www.w3.org/1999/xhtml">
<head>
    <meta http-equiv="Content-Type" content="text/html; charset=iso-8859-1" />
        <title>The Marine Corps Online Uniform Manual</title>

    <link href="css/level_style.php" rel="stylesheet" type="text/css" />

</head>

<body>

<?php $includeFile = $serverRoot.'/page_content.php';
                                                    if
(file_exists($includeFile) && is_readable($includeFile)){

    include($includeFile); } ?>

</body>
</html>

```

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